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HONORABLY MENTIONED.

"If a house be divided against itself, that house cannot stand."

NAVAL REFORM.

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After that long-deferred hope which, for so many years, made sick the hearts of our naval officers, and after passing successfully through the experimental stage, we are now in the position to realize that the New Navy with its splendid ships, engines and guns is a very real fact. Much as has been done in the building line and great as is the change that has been wrought in the character of the fleet, there yet remains to be accomplished much more development in the same direction before we can feel that our Navy will be equal to the demands that are, even in time of peace, constantly being made upon it, or that it will be entirely creditable to the great country whose dignity it has to maintain. Satisfactory as it is to contemplate the rapid growth of our fleet

and to know that our new vessels, class for class, are more than the equals of their similars in other navies, we must not forget that it takes something more than war vessels to make a navy, and that fine vessels alone do not necessarily make a fine navy. Laying aside the question of men with which to man the new fleet, which question is one of such grave importance that it should be dealt with separately, let us ask as to the fitness of the present corps of officers for the new conditions that confront them.

For the purposes of this paper it is assumed that the naval officer of to-day is not thoroughly qualified for the work that lies at his hand, and on this assumption it will be my endeavor to suggest such changes in training and reformation of organization as will remedy existing inconsistencies and shortcomings. I am aware that the expression of the sentiment just uttered is rank heresy against one of the fondest beliefs in the whole naval rubric, but I believe it to be true nevertheless. The naval cadet, from the day of his admission to the Academy until he is called inside the hollow square to get his diploma, daily hears the changes rung upon a dogma to the effect that the officers of the United States Navy are the best educated and the most skillful professionally of any in the world, and this belief is likely to become an article of faith with him for life unless he should happen to be much thrown with foreign officers and thus learn by observation that his own service has not a monopoly of all naval wisdom. It is going too far to say that among the officers of all modernized navies we are the least adapted to our surroundings of any, but it is not saying too much to intimate that we have several things yet to learn and several important changes in our organization to submit to before the personnel will be up to date in comparison with the material it has to handle.

All the suggestions that follow are based on the theory that the chief reason for the maintenance of a navy is *war*. However profound may be the peace of the World or however pacific may be the mission of a man-of-war sent into foreign waters, the facts must not be lost sight of that the ship is armed to fight, that her people must be fighting men in their various capacities and that, with this one great requirement fulfilled, all the other functions of a public armed vessel will follow in their regular order, but always subordinate to the main object.

The difficulty of the task of demonstrating the possibility of a new naval organization in which all existing differences will be reconciled and which will merge the present official body into a homogeneous whole is obvious, yet such a naval reform must be experienced before we can hope for genuine efficiency in the future. In developing a scheme for the improvement of the present organization, I shall start with the principle that all officers must be graduates of the Naval Academy, excepting, of course, the surgeons and chaplains, whose professions naturally demand special forms of education. A few exceptions might also be made in the various arms of the service for the benefit of the enlisted men, who could qualify for commissions under conditions similar to those in force in the navies of several countries whose forms of government are less democratic, in theory at least, than our own. This, however, is a matter that properly belongs to the discussion of the future status of the enlisted force and is, consequently, out of place here except as a suggestion. With a uniform system of naval education once well established, it will follow that all officers on board ship, with the necessary exception of the surgeon and chaplain, will be combatants, familiar with the use of the ship's weapons, accustomed to handling men in a military manner, and competent, in cases of necessity, to exercise their abilities in this direction even though they may be following some specialty not essentially military in the ship's organization. Having used the word "combatant," which, in these days of peace, is so often misused and is so provocative of fruitless discussions, I will here quote the definition of it as given by Woolsey in his "Introduction to International Law," and say that in the future use of the word, in this essay, its meaning will be understood to lie wholly within the limits of the definition.

"A *combatant* is any person directly engaged in carrying on war, or concerned in the belligerent government, or present with its armies and assisting them; although those who are present for purposes of humanity and religion—as surgeons, nurses and chaplains—are usually classed among non-combatants, unless special reasons require an opposite treatment of them."

In any proposed plan of naval reform it is perhaps needless to suggest any change in the present methods of making appointments in the medical corps, as the results are now so excellent

that it is doubtful if any improvement can be made, unless the pay and official standing of the junior members of that corps be raised, in which case one would naturally expect keener competition for the more desirable positions than is now the case. In regard to the status of the medical branch of a military organization there seem to be only two courses that can be sensibly followed, and they are the opposites of each other. In one case, the surgeon on shipboard might be regarded simply as the medical attendant of the crew, the officers and men together composing the community in which the surgeon lives, and his obligations should be the same as in any other community in which he is responsible for his acts to the laws of his country and the rules of his profession. He should be entirely free from the restraints which a military organization necessarily imposes upon its regular members, at liberty to go and come as he pleases, to attend to his patients in his own way and in his own time: in short, he should be the neighborhood doctor pure and simple, and not required to masquerade as anything else. His relation to the service would be the same as exists between any attending physician and the railway or other corporation which employs him for specified periods, without promise of permanency, increased compensation for continued service, or ultimate pension.

If, on the other hand, the advantages to the service of a permanent organization are considered important enough to warrant the existence of a corps of naval surgeons divided into grades according to length of service, with a regular system of promotion from one grade to another, an increasing scale of pay, and a retired list as a reward for long service, then should the members of such a corps have a more definite official status than is conferred upon them by the privilege of wearing a uniform similar to that worn by officers. If the medical man must make every act of his life conform to naval regulations; if he must accustom himself to all the deprivations and restrictions under which naval officers live, bear the same expenses and share the same life with them, and, above all, be answerable to naval courts-martial for his professional and personal conduct, it seems only just that he should be an officer in fact as well as in outward appearance. The present status of the medical corps of the Navy is a compromise between the two conditions just described and is unsatis-

factory to all concerned, as everybody knows. Which of the two extremes will it be to the benefit of the service to adopt?

Whatever may be said in favor of the first, or contract surgeon method, I think that the many disadvantages involved in having on board a ship a person independent of the rules and routine of the ship are sufficient to condemn the proposal without our entering into a discussion as to its merits or demerits. Accepting this to be the case, the following scheme is proposed for governing the admission of surgeons into the service in the future and defining their subsequent official standing:

Candidates for the position of surgeon in the Navy must be not less than twenty-six nor more than thirty years of age; they must be graduates of a medical school of recognized high standing, and must have been engaged in general medical practice for not less than four years. The scope of the examination for admission will be such as to demonstrate high professional knowledge, and the possession of all the accomplishments considered necessary for a naval officer to have. The lowest grade in the medical corps should be that of surgeon, corresponding in rank and pay to the grade of lieutenant in the Navy, and the medical officers should be given titles that will indicate both their profession and their rank as officers of a military organization. For want of something better, the title of "Surgeon-Lieutenant" is suggested for the lowest grade, and similar ones for the higher grades, which titles will be recognized by the readers of this paper as having been adapted from the British Army, and are, I think, preferable to the double titles of rank and calling now in use in our own Army; they are certainly infinitely preferable to the curious, and in some cases meaningless, titles with which our naval medical men are now saddled. Officers of the Navy junior to the lieutenants' list may object to these surgeons, without any previous naval service, coming in ahead of them in the matter of rank and pay, but the grounds of such objection, with which we are all familiar, do not appear to be well taken. The surgeon's duties are of a special character, and from their very nature cannot conflict with those of any other officer, nor is his presence on shipboard in the capacity of an officer any menace to the authority or privileges of any class. His is called the "noblest of all professions," and wherever men live his services take precedence over all other needs, and he is

rewarded and honored accordingly. Let us cheerfully accord to the surgeon in the Navy the material competence and dignity of station that are universally admitted to be his by right of his talents in all civil communities.

The chaplains, faithful to the peaceful character of their calling, do not exhibit any of the signs of discontent and unrest that are now prevalent in the other branches of the service, which fact admonishes us to let well enough alone so far as their numbers and present status are concerned. I will venture the suggestion, however, that their field of operation be limited to the navy yards and shore stations, and that sea duty be not required of them. This will not cause any great change from existing practice, as the latest Navy Register (July, 1893) shows that only five of the twenty-two chaplains on the active list were at sea, one of the five being on the short practice cruise of the naval cadets from Annapolis. The presence of a chaplain on board ship is undoubtedly beneficial to the morals and manners of officers and men, but in view of the crowded condition of our modern ships, and especially in view of the sacrilegious purpose for which the ship is maintained, the fitness of the chaplain's presence may well be questioned. When a body of men armed with deadly weapons go forth upon the sea in a ship bristling with guns and loaded with explosives, the natural inference is that their mission is not one of peace on earth or good-will towards men, and one cannot help thinking that an apostle of the Prince of Peace is in strange company when he joins himself to such an expedition.

The officers for all the remaining branches of the service—line, pay department, engineers, naval constructors, professors of mathematics, civil engineers, and marine corps—should, with possibly a few exceptions, as suggested above, be commissioned from the graduates of the Naval Academy, and the necessary changes in the curriculum of that institution to make this possible should be made forthwith. I do not propose within the limits of this paper to elaborate upon changes that may be desirable at the Academy, knowing that to be a subject for the Superintendent and Academic Board to deal with, should any changes ever be seriously undertaken. To touch upon this subject briefly, and merely in the form of suggestion, I will say that there seems to be a general belief in the service just now that the Naval Academy is running

too much to theory, and is giving scarcely enough attention to those practical matters that have to be dealt with so constantly in real service. Extensive knowledge of interior ballistics and thermodynamic functions is a good thing in its way, but is not of much application to the duty of keeping a gun-mount or a triple-expansion engine in a state of ready efficiency, yet the real duties before our young officers (and old ones too) are largely of this practical nature. It is true that some naval officers are making good use of the theory they have learned at the Academy by applying it to the design of ships, engines and guns, but many more find their life-work in taking care of these things in service, and to the majority should be given the preference in training. The scientists will develop themselves as they are needed, just as they do in other callings.

The present period of six years devoted to the instruction of the cadets, the two last years being spent in cruising ships of the Navy, may well be retained, but it seems that the existing high limits of age for admission might be reduced considerably. The younger the youths come under the influence of their naval instructors the more readily will they receive the impressions and ideals so necessary for the peculiar calling they are to be trained for, and for this reason I would like to see the high maximum age of twenty years now allowed for admission reduced to not more than sixteen, while the minimum age should be fixed at twelve or thirteen at the most. The present age limits, I believe, were arrived at as a result of an unconscious concession on the part of the academic authorities to the supposed importance of theoretical as opposed to technical knowledge, each department of learning gradually adding a little here and a little there to its course until the elastic limit, so to speak, of the cadets had been reached, and it was found necessary to procure older and tougher material upon which to operate. With the present age limits it is possible for a young man to enter the Naval Academy after he has taken a degree at a college or university and had his life aspirations so shaped as to be beyond the influence of an entirely new course of training, while his age during his cadet career will be not less than were the ages of the executive officers of our largest frigates at the time that the Navy was engaged in the greatest operations known to its history.

With a reduction in the age of the cadets would come a corresponding modification of the present courses of study, tending to limit the subjects taught to those that are directly applicable to the various branches of the naval profession: mathematics no further than is necessary to arrive at the solution of the problems in navigation, surveying and steam engineering, that officers have to deal with in the daily routine of a ship in service; the physical sciences so far as they are are of practical application to naval requirements; history, grammar, composition and book-keeping should be dealt with as thoroughly as these subjects are taught in the high schools of the country. The acquisition of at least one foreign language—French or German—should be as important a requirement as mathematics. Cadets of scientific bent and marked excellence in their studies should be encouraged to further knowledge by elective courses in the branches in which they excel. In the academic course more time should be devoted to drills, practical exercises and recreation than is now the case, and careful attention should be given to the physical development of the cadets. A vigorous physique, indicative of wholesome blood and a clear head, is as important a factor in the make-up of a naval officer who hopes for success in his profession as is scholastic excellence, although we are apt to lose sight of this fact on account of the overshadowing influence of modern scientific developments. It may be a shock to the notions of officers who are accustomed to the present routine of the school to hear it suggested that at least every other afternoon should be wholly given to the cadets for their own recreation—boating, ball-playing, fishing, etc.—but such an innovation could not be otherwise than beneficial, especially if the cadets of the future are to be of a proper school-boy age as herein proposed.

The two years of probation at sea after the academic course should be devoted to a systematic continuation of the instruction of the cadets rather than to an attempt to exact the performance of responsible duties from them, which purpose can be more readily carried out when the cadets are several years younger than they are at present. It may be too much to require from them theoretical study and recitations, but they should be obliged to preserve their observations relative to gunnery, machinery, and ship's duties generally, in well-kept note books, and should, from time to time, be questioned or examined in these professional subjects by

the proper officers, the results of such examinations to be used in making up their cruise reports. Besides the experience accorded them in the subjects above mentioned, one or two cadets at a time should be assigned to the pay department for a period of several months, and required, under the instruction of the pay officer, to familiarize themselves with the details pertaining to that department; this for a reason that will appear hereafter. At the end of the two years the class of cadets should be assembled at the Naval Academy for final graduation and the successful ones commissioned as ensigns of the line, with the exceptions necessary to make up the annual waste in the Marine Corps.

In the new naval organization I propose to group into one staff corps the professors of mathematics, naval constructors, civil engineers, and the higher grades of the engineer corps, of the existing naval establishment. To the membership of the proposed corps I would add also a number of ordnance experts, sufficient for the performance of the engineering work of the Bureau of Ordnance. This corps, containing as it would, the scientists needed in the naval establishment, should be the *corps d'élite* of the service. The different professions represented in it are those known in civil life by names indicating various kinds of engineering, or are closely allied to some engineering pursuit, for which reason I would call it the Engineer Corps, or, perhaps, the "Corps of Naval Engineers." The officers of the different corps, which it is proposed to amalgamate, would go into the different grades of the new corps, in the order now established by their dates of precedence, and their individual specialties, which they would continue to follow, would be indicated on the new list of officers by a letter prefixed to the name, as (*O*), ordnance; (*C*), construction, etc. The lowest rank in this new corps will be lieutenant, and the highest, rear-admiral; officers of the latter rank to be chiefs of the bureaus of Ordance, Yards and Docks, Construction, Steam Engineering, and perhaps, Equipment, the scope of the latter bureau becoming so rapidly of an engineering character that before long it may be advantageous to class it with the other engineering branches, and provide a place for its specialists in the ranks of the engineers. The rank of rear-admiral for bureau chiefs, hereby suggested, does not contemplate any increase of rank over the present arrangement, but is proposed to conform to

the change of title of commodore to rear-admiral, which is suggested further along in this paper.

Leaving the specialists of the Bureau of Equipment out of the question for the present, this proposed new engineer corps should contain about one hundred and eighty-six members, with the following distribution of rank: Four rear-admirals, (chiefs of bureaus); twenty-two captains; fifty commanders; sixty lieutenant-commanders; and fifty lieutenants. The different specialties should be represented by forty-two ordnance officers; ninety engineers; ten mathematicians; thirty-two constructors; and twelve civil engineers. It may be found advantageous to change these figures to some extent, in putting this plan into execution, although they have been arrived at after a very careful study of the requirements of the service, as shown by the actual duty now performed by the members of the various corps affected by the change. The ordnance engineers of this corps would perform the duties now assigned to the ordnance experts on shore, including duty at the Naval Academy, and allowance has been made in determining their number for the detail of a fleet ordnance officer to each cruising flagship, the necessity for creating such an office being obvious, when we consider the remarkable developments regarding guns, armor, torpedoes and projectiles that are constantly going on. The engineer specialists would perform the more important of the shore duties now pertaining to the engineer corps, and would also go to sea as chief engineers of all vessels of five thousand horse-power and upwards. The professors of mathematics, constructors and civil engineers would continue with the duties now assigned to officers of those corps, except that, I think, there should be a naval constructor attached to each squadron in service. The number of construction engineers proposed above is sufficient to allow such details to be made, especially when the present building programme is nearly enough completed to permit the release, for other duty, of officers now employed as inspectors of hull construction at the different shipyards.

Promotion in this corps will be by seniority, irrespective of specialty, except that the chiefs of bureaus will be selected from the two highest ranks of officers, and will, of course, profess the specialty represented by the bureau whose chief is to be appointed.

Appointments to fill vacancies shall be made entirely from the line of the Navy, the officers so transferred to enter the engineer corps at the foot of its list of lieutenants, and to take rank therein, and with all other officers, according to date of the commission issued to them at the time of such transfer. (In the original organization of this corps from several others, the officers entering it would necessarily take rank with each other according to date of precedence, as before proposed.) To be eligible for transfer an officer must have held a commission in the line for not less than five years, and must have passed a satisfactory examination before a board of officers, representing the engineering specialty in which the vacany to be filled exists. Officers desiring to fit themselves for examination shall be allowed every facility possible by the Navy Department, in the matter of assignment to duty, in places where opportunity for preparation exists, and in case a course of study in some special subject—civil engineering, for example—is requisite, leave of absence shall be allowed for that purpose. A liberal policy in this direction by the Department would be more beneficial to the officers concerned, and more economical for the Government, than would result from the maintenance of a post-graduate college for officers, as is sometimes recommended.

Officers of the line, transferring into this staff corps, would not forfeit their status as naval officers, but they would, necessarily, have to relinquish their prospects of rising to high naval command, which distinction would naturally remain for the officers who find their life calling in the details of administration at sea. The proposed engineer corps would correspond very closely, in its objects and relation to the service, with the corps of ordnance and engineers in the U. S. Army, and its official standing could be well defined by adapting existing statute laws, which prohibit the exercise of command by the officers of those corps, except in cases where they are specially so directed by authority of the President. This would leave it possible for an expert ordnance officer, for example, to be assigned to the command of a shore station where ordnance material only is manufactured, and would leave the command of ships and squadrons in the hands of sea officers, where it belongs. As a recompense for giving up the alluring possibilities of high naval command, the officers of this staff corps would have the comforts and the safety of life on shore and the satisfaction of pursuing a chosen profession.

In the reorganization of the pay corps, I suggest a small number of officers as the permanent part of the corps, for the performance of the more important duties, leaving those of lesser importance, both afloat and ashore, to line officers of or below the rank of lieutenant. The naval pay corps performs the same duties that in the U. S. Army are assigned to three separate departments, in all three of which the permanent officers are of comparatively high rank, and have the duties involving the most responsibility, the minor duties being entrusted to line officers, temporarily detailed for the purpose. The Army Register shows the following numbers and divisions of rank of these officers :

	Brig.-Gen.	Colonel.	Lt.-Col.	Major.	Captain.
Quartermaster's. Dept	1	4	8	14	32*
Subsistence Dept.	1	2	3	8	12
Pay Dept.	1	2	3	30	..
Totals	3	8	14	52	44

The total number of these officers (121), shown by the table, is considerably more than will be needed in the new naval organization, as the Army is a much larger establishment than the Navy, although the naval organization will, for reasons not necessary to enlarge upon here, require a greater number of pay officers than would be determined by a simple ratio of numbers in the two services. It is suggested that the permanent part of the new pay corps be composed of fifty-five officers, with rank as follows : one rear-admiral (for chief of bureau) ; twelve captains ; twelve commanders ; and thirty lieutenant-commanders. This number should be sufficient for the execution of all shore duty, now shown by the Navy Register to be assigned to officers of and above the grade of paymaster, and will also permit the detailing of pay officers to flagships and to other vessels having crews of, say, four hundred men and upwards.

The chief of the pay department should be selected from the officers of the two highest ranks, all other promotion in the corps to be seniority. Vacancies in the lowest rank to be filled by the transfer of line officers who have, by regular assignment, performed duty under the pay department for a time amounting, in the aggre-

*Includes two military storekeepers with rank and title of captain.

gate, to not less than three years, and who have passed a satisfactory examination before a board of pay officers.

In dealing with the Marine Corps, the writer realizes the difficulties that beset the subject and the impossibility of suggesting any change, even though it be for the general benefit of the service, that will not meet with condemnation from one or the other of the two factions that have been created by the much-discussed question of marines or no marines on shipboard. That the traditions of the Marine Corps are founded on an existence older than the history of the Navy itself; that the marines have always been true to their motto—"*semper fidelis*;" that they have patiently borne their full share of the toils and privations of the service without reaping a proportionate share of the glories they have aided in winning, and that the organization of the corps is a model of military discipline are all facts that promise faithfulness and efficiency in the future, and are considerations that should not be lightly passed over by any one, whether disposed or not on general principles to join in the cry that "the marines must go." After carefully reading much of the literature on both sides of this vexed question, and viewing it from a standpoint entirely free from prejudice, the writer is inclined to believe that the best interests of the service will be advanced by the adoption of a mean between the two extremes proposed for the future employment of the Marine Corps.

The advantages that some claim will result from the withdrawal of the marines from service afloat appear to me more probable of realization in the case of small ships than with the larger and more commodious ones, while the utility of a marine guard on a flagship where the many subdivisions of a large ship make the performance of police duty difficult, and where many ceremonial functions have to be observed, cannot be denied. It is therefore recommended that the marines be withdrawn from all vessels except flagships, with the consequent increase in numbers of the guards at the various navy yards, where, according to the marine officers, there are never enough men for the proper performance of the duties required of them. This will involve no change in the numbers of either officers or men in the corps, and there does not appear to be any necessity for recommending any change, except in the event of the United States becoming possessed of a system

of sea-coast defenses worthy of the name; then the Marine Corps should be increased to such an extent that it could man those defenses in addition to its other duties, and it should be the duty of every officer of the naval establishment, line and staff alike, to advocate such an increase as being one that would place the defense of the coasts where it belongs, and at the same time provide a force for the Navy to draw upon to augment its ships' companies when Congressional frugality makes adequate crews impossible, as sometimes occurs.

If the total number of officers now in the line of the Navy be accepted as substantially the correct number for the performance of necessary duties under the existing organization, then, in view of the foregoing recommendations, this number should be decreased by about forty on account of the line officers who go into the staff as ordnance engineers, and increased by the numbers cut off from the pay and engineer corps, the duties of such officers devolving upon the line: this would amount to a net increase in the line of one hundred in round numbers, an increase that would be very difficult to obtain. A comparison between our numbers of ships and officers, and those of some of the chief foreign navies shows that we have proportionately more officers of the different branches than are found necessary for efficient management in the foreign services, the disproportion appearing in bold relief when we compare the actual numbers of officers serving on ships of the same size in the different services. Take the French cruiser Alger of 4160 tons, the British cruiser Severn of 4050 tons, and our Charleston of 4040 tons; the Alger has seven line officers, four engineers, one surgeon and one paymaster—thirteen in all; the Severn has seven line officers, two surgeons, two paymasters, four engineers, one chaplain and one marine officer—seventeen in all, and the Charleston has eleven line officers, three surgeons, one paymaster, four engineers, one chaplain and one marine officer, a total of twenty-one. The British gunboats of the Archer class, of 1770 tons, and the French cruiser Rigault de Grenouilly of 1710 tons, carry only nine commissioned officers, while our 1700 ton vessels have thirteen and fourteen. It is difficult to find examples of the foreign vessels having as many officers as our own, although there are a few exceptions to the rule, one prominent one being in the comparison of the big cruisers New York and Blake, which

shows that the American ship has only one more officer than the British one has, the numbers being twenty-seven and twenty-six respectively.

These comparisons indicate that we can easily manage our cruising vessels with fewer officers than are employed on them at present, for we are surely capable of performing with the same means that which is habitually well done in foreign navies. The writer is, furthermore, of the opinion that considerable of the present "shore duty" can be dispensed with, without injury to the service. The last Navy Register shows that less than one-half of the officers of the sea-going corps are actually serving at sea, and that much of the duty to which officers are assigned on shore is only remotely connected to a sea officer's profession. A careful examination of this subject develops the belief that the present number of line officers is entirely adequate to the duties that will be required, even after the line has assumed the minor duties of the pay and engineer departments, and making due allowance for any probable increase in the number of ships. For the new Navy, it is therefore proposed that the number of line officers and their division into ranks shall be as follows:

Six vice-admirals. (In lieu of the present rear-admirals.)
Ten rear-admirals. (In lieu of the present commodores.)
Sixty captains.
Seventy commanders.
One hundred lieutenant-commanders.
Three hundred lieutenants.
One hundred lieutenants of the junior grade.
Eighty ensigns.
Making a total of seven hundred and twenty-six of all ranks.

The present naval establishment, as shown by the last Navy Register, consists of seven hundred and twenty-seven line officers, one hundred and sixty-eight medical officers, ninety-five pay officers, one hundred and eighty-three engineer officers, twenty-two chaplains, twelve professors of mathematics, twenty-nine naval constructors and ten civil engineers; a grand total of twelve hundred and forty-six officers on the active list. Under the reorganization scheme proposed in this paper, the total number of commissioned officers in the Navy would be eleven hundred and fifty-seven, of whom seven hundred and twenty-six are line officers, one

hundred and sixty-eight surgeons, fifty-five pay officers, one hundred and eighty-six engineers and twenty-two chaplains.

The advantages claimed for the proposed reform are:

1. A reduction ultimately in the total number of commissioned officers, without going below the number actually necessary to meet any demands that are likely to be made on the service.

2. The establishment of a corps in which officers of scientific bent may find a permanent field for the exercise of their chosen specialties after they have been long enough in the service to know exactly in what direction their talents lie.

3. Incidental to the above is the advantage in the method of selection, whereby skilled specialists are produced in the same manner that they are developed in civil life; *i. e.*, by natural selection.

4. Simplifying the naval establishment, by reducing the number of the staff corps from seven to four.

5. The reduction in the number of special classes of officers on board ship, thus making the official body more homogeneous, and consequently more efficient.

6. The removal of grievances which provoke the so-called "line and staff" fight which now distracts the service, and makes it appear ridiculous in the eyes of the public.

Of these advantages, the chief one is evidently that which reduces the official personnel of a ship to one class of officers, with the sole exception of the surgeon. As this involves considerable versatility on the part of the officers, the proposal is sure to be antagonized by some, who will use as an argument the assertion of an ancient proverb, regarding the inefficiency of a jack-of-all-trades. If this proverb were true, which I deny, with all due respect to its age, its application to present naval conditions is very remote and far-fetched. With those officers, fortunately few and far between in our service, who seek to cast a veil of mystery over their own peculiar specialty, be it steam engineering, gunnery, seamanship, bookkeeping, or what not, one cannot be very patient. The days of necromancy and mysticism are over, at least in our country, and we have no arts so occult as to be possible only to a chosen class or a chosen few. The duties of the lower grades of officers are now of a varied nature, yet are all well performed, which fact indicates like efficient performance after we

have added somewhat to the range of these duties. The more important duties, involving considerable experience and high professional ability, in the various naval branches, will be attended to by the older officers, as before recommended; these officers will be specialists in their way, but, as they will have been trained in the ranks of the line officers, they will still be in touch with them and capable of fully appreciating the necessity for harmonious interrelation of the various duties to be performed. Friction in ship life, due almost entirely to corps jealousies, will be reduced to a minimum when there is practically but one corps, and corps prejudice as an element in the administration of naval discipline will be eliminated.

The innovations proposed as to the scope of the future line officer's duties are not found to be especially great when we look into the matter a little. The modern gun and its mount is quite as complex a piece of mechanism as was the marine engine of thirty years ago, and should require fully as much engineering intelligence in its management; many other machines scattered about a modern ship, with which line officers have to deal, are either steam engines or are their similars, so that if the line officer is now really competent for the carrying on of his established duties, he has no long step to take to become familiar with the larger and more complicated machines that constitute the ship's motive power. Conversely, the engineer who knows his business in the great engine and boiler-rooms, has no mystery to unravel in connection with gun mounts or ammunition hoists, nor need he fear any serious obstacles in the way of acquiring a knowledge of navigation and surveying, after he has mastered the mathematics necessary for his own profession.

The only duties herein proposed to transfer to line officers, that are not closely allied to their present duties, are those pertaining to the junior grades of the pay corps, and, with all respect for the opinions of the pay officers, it is believed that such duties are not of a sufficiently complex character to absolutely require a specialist for their proper performance. The graduates of the Naval Academy, either under the present system of education or under the one suggested in this paper, are surely as competent to acquire the necessary knowledge about the ship's books and business methods as are the young men who enter the pay corps by civil

appointment, and who are generally fresh from their own schools and colleges. Lieutenants, and other officers in command of the Coast Survey vessels, habitually attend to the purchasing and disbursing business of their vessels, and if any disaster has ever resulted from their lack of business knowledge, the writer has been unable to learn of it. The advantages of having a pay officer on board ship, who, by previous training, is competent to perform military and other duties, not immediately connected with his own profession, are too obvious to need comment. By assigning him to the command of the powder division, as was quite generally done during our last war, and which it is believed could be done without embarrassing his performance of duty as pay officer, the necessity of having an officer especially for that division would be obviated, and that much living room saved, which we all know is a point worth gaining, especially in small ships.

We now come to the question of applying the suggested reforms to the present naval establishment. If put into immediate effect, the six rear-admirals and ten commodores will become vice-admirals and rear-admirals respectively by simply changing their titles. The eighteen senior commanders would become captains by promotion. (I am necessarily using the figures given in the last official Navy Register, dated July 15, 1893.) Five lieutenant-commanders would be advanced to commanders; thirty-two lieutenants become lieutenant-commanders; all of the junior grade lieutenants and the nine senior ensigns advance to the lieutenants' list, and one hundred ensigns become lieutenants of the junior grade, leaving eighty-one ensigns on the list—one more than the proposed number. If forty officers of various ranks go into the staff as ordnance engineers, the resulting vacancies in the line will bring the number of ensigns down to forty-one. Passing to the staff, we will have the number of officers in the medical corps unchanged, but the junior members of the corps will be advanced to surgeons ranking with lieutenants. Fifty-five pay officers and ninety engineers, taken from the top of their lists, will go into the permanent staff corps before proposed, leaving the forty junior pay officers and ninety-three engineers to be disposed of: these I suggest be transferred into the line according to the dates of their present commissions, they to be regarded as additional to the list of officers in the ranks in which they appear;

to be continued in the performance of their special duties and to be the only officers eligible for transfer into their respective staff corps (in their regular order of seniority) so long as any of them remain on the line lists. The names of such additional officers will be distinguished in the Navy Register by the letters (P) and (E) respectively, to indicate the special duties for which they are available. The twenty-three junior assistant engineers now on the active list have held commissions less than five years and are consequently still young enough and not too far away from their Naval Academy training to easily acquire the technical knowledge necessary for junior line officers, for which reasons it is suggested that they be transferred to the line entirely and not continued as engineer specialists; this would make the number of ensigns sixty-four. The number of professors of mathematics (10) proposed for the new engineer corps is two less than the existing number; probably two of the present members of that branch would elect to become ordnance specialists, which would complete the suggested number of such experts and adjust the number of professors to that proposed. An increase of two civil engineers and three constructors is also involved in the figures before proposed for the new engineer corps, and it is believed that five officers now in the line will be easily found willing and competent to fill the vacancies. This will make the final number of ensigns fifty-nine, or twenty-one less than the number proposed for that rank, which, with the vacancies that will occur during the year in the Marine Corps, will make the usual number of places for the next graduating class and thus prevent any possible injustice in that direction.

The question of pay is one that naturally comes up in any proposition designed to increase the efficiency of the personnel, and is one that is sadly in need of reform and simplification. There are now, including the various combinations possible with the retired list, no less than *seven* different rates of pay which an officer of any grade may receive, which is a complication sufficiently serious in itself to call for correction. The matter of naval pay has been so much discussed that it is needless to review any of the arguments in this paper, beyond admitting that those who oppose the proposals looking towards an equalization of pay have as much substantial right on their side as have those who advocate

such a change. Under a new system of naval education and organization, as is herein proposed, the official status of officers of different branches would be readjusted upon a basis so much nearer equality that the various good reasons now existing why the pay should not be equal would vanish, and it would then become simply a matter of course that all officers of any particular rank or grade, irrespective of corps, should receive the same pay. Such is the case in the U. S. Army now, and there does not appear any easier method of settling the question of naval pay than by adopting the pay table of the sister service. This would be a hardship to some naval officers by reducing their pay, while it would benefit others, but the differences would not be great in either case, and it is believed that with this system of pay once well established in the Navy all officers would be satisfied with it.

The change is therefore recommended as a part of this plan of reorganization, subject to such modifications in the way of allowances as the difference between the two services may require.

In the cases of commanding officers of ships or squadrons, a deviation from the adopted pay table should be made in the form of an allowance to cover the expense of entertaining foreign and other dignitaries, and thus relieve these officials from the present hardship of being obliged to entertain their country's guests at their own expense. Officers not belonging to the permanent pay corps, who may be detailed as pay officers, either afloat or ashore, should also have a special allowance sufficient to enable them to pay the premium on the bonds which they would be required to furnish. With these exceptions the pay and allowances of all officers should be absolutely equal in each rank.

In dealing with the subject of this paper, the writer has been obliged to handle straw that has been well threshed over before, so that there is little more to hope for than the discovery here and there of some grains of good sense that have been overlooked. If any of the ideas herein advanced are found worthy of discussion by the members of the Naval Institute, and if such discussion will lead to any results tending to simplify the present naval organization, or to establish a better understanding between its various parts, then will the purpose of this essay be fulfilled. I do not, personally, favor all of the changes proposed, but have suggested them from a knowledge that some sacrifices and concessions must be

made on all sides before we can hope for a united and contented body of officers, entirely in step with each other and always ready to zealously work together for the common purpose for which they exist. Certain it is that the present organization, with its component parts working at cross purposes, each faction pulling hard enough to prevent the progress of the others and unable to advance itself, is accomplishing nothing more than to stand unsteadily on its obsolete foundations, in momentary danger of tumbling in ruin about the heads of the contending forces. Let us learn a lesson from the words of the Great Teacher and accept the truth of the saying, that "If a house be divided against itself, that house cannot stand."

DISCUSSION.

Captain H. C. TAYLOR, U. S. N.:—The essayist's well written and clearly expressed views on Naval Reform, recall the circumstance that the formation of a "scientific corps" was proposed at Annapolis in 1870 and 1871, and was considered and discussed at some length, though informally, by a number of officers there and in Washington at that time. The features of that plan were nearly identical with those of the present essay.

The sea-going requirements, as I remember the old plan, were more emphasized, demanding a compulsory two years out of seven for all ranks of the special corps, in order that they should not lose their touch with the service afloat, but, in general, the ideas of the two plans are very much alike.

There are many ways in which such an organization would assist the general efficiency of the Navy, especially in the preparation of material. Much of the ability of our Navy would tend towards such a corps, many of our best minds would be drawn into it, if it were regarded as a place and a duty of the highest honor. In this would lie, however, the danger to naval efficiency.

If we are to make it the *corps d'élite* of our service, we will thus invite a slow but sure deterioration of naval usefulness. If we make any body of officers a *corps d'élite* other than those who command men and fight battles, we base ourselves upon a fallacy.

We are a military organization; our first care, the duty that should engage our most serious attention, is the command of men. Our system

should be such that our ablest minds should be attracted to that duty, and retained in that occupation. If there be, in the glitter and glamour of a *corps d'élite*, a temptation for bright intellects among our young men, let us see to it that the name, and the reality of such a corps be bestowed upon those officers who have to do with the men, who command them, care for them, and fight with them. Let rank, comforts, and emoluments be provided for those excellent and talented officers, who, as scientists, will perfect our naval material, but let us not forget in our present infatuation with that material, that, when we first omit to place our fighting men in the highest place of honor and regard, we cease to be a military body. We may be something else, something very good perhaps, but not a military body, not an efficient Navy.

With reference to the marines, I have always regarded them as an unmixed good. They are a highly important factor in our fighting efficiency. As such, and without reference to their police duties, which is a secondary matter, I hope to see their numbers increased both afloat and ashore.

I believe we shall always need them, as well as the seamen for landing; and, when on board, I see no reason why they should not man some of the guns.

I agree with those who oppose an undue specialization of function in a military organization. The tendency to differentiation of duties in the Navy, as in some industries on shore, is in danger of being carried to excess; but the office and function of marines on shipboard has not been created to-day. It has, on the contrary, existed in navies since the earliest historical periods. I regard their special duties, in war and peace, as so integral a part of a naval system, that, should the corps be now removed from ships and their work be performed by the seamen, I do not doubt that those seamen and the officers assigned to command them, would, in a few years time, evolve themselves by the constant action of natural causes into a new corps, identical with or closely resembling the present marines.

In addition, if, as some believe, the *mêlées* of future fleet battles are to include much boarding and hand-to-hand fighting, the qualities and training of the marines are such as to render them most valuable in connection with the seamen upon such occasions.

Engineer-in-Chief GEORGE W. MELVILLE, U. S. N. :—Having been invited by the Council of the Institute, although not a member, to discuss the paper by Passed Assistant Engineer Bennett, entitled "Naval Reform," I have pleasure in complying.

First of all, I would most heartily commend the sentiment which prompted Mr. Bennett to write such an article. We hear a great deal in the press about the unfortunate lack of harmony in the service; and, while I am sure that every officer would be glad to deny the allegation, we are

compelled unfortunately to admit that it is true. Whether Mr. Bennett has hit on the right solution of the difficulty or not remains to be seen. I am not prepared to admit that he is entirely right.

His idea is that the lack of harmony is due to difference in the early education and methods of appointment of the officers in the various corps, as well as, to some extent, the differentiation of duties after graduation, where the early education has been the same in all cases at the Naval Academy.

This is an easy view to take, and is probably because the two circumstances are contemporaneous, but it does not seem to me that it is entirely sound.

He must have been a very unfortunate officer in his relations with others in the service who has not made at least one cruise where things went on on board ship as if it were a happy family. I know of many cases where ships have made entire cruises with the pleasantest relations existing among all the officers. Now, the fact that this can occur on some ships, while on others there is dissatisfaction and lack of harmony, would seem to indicate that the cause of the trouble is in individual peculiarities rather than in general class feeling.

It seems to me, therefore, that the remedy for the trouble is to be sought rather in changes in existing law or regulations whereby the possibility of personal spleen being worked out to the disadvantage of others would be reduced to a minimum if not entirely obviated, and an entire stoppage of that nagging interference in other people's duties, which creates so much trouble, would be secured. I do not know that I am prepared at the present moment to give details of how this could be done; but inasmuch as this lack of harmony has been reduced in our sister service, the Army, to so small a degree as to be almost non-existent, it would seem that following out the course adopted there ought to be productive of like result in our own service. This would be to give every officer in the Navy definite military rank, and have the fact of his importance as a member of the organization recognized by every other officer.

While I have great respect for the Naval Academy, and for the able officers who have been turned out from that institution, I cannot agree with the essayist that all officers must be graduates of the Naval Academy except surgeons and chaplains. In saying this, I want at once to meet the criticism which may naturally arise, that my views on this question come from the fact that I am not a graduate of the Naval Academy myself. So far from having any feeling against graduates of the Naval Academy I have the warmest regard for them, and this is shown by the fact that, during my term of service as Chief of the Bureau of Steam Engineering, nearly all of my assistants have been graduates, and the fact that, whenever I have had an opportunity, I have borne most cheerful testimony to their high average ability and to the exceptional talent of some who have been my assistants. I recognize the fact that there are decided advan-

tages in having the officers of the service educated at a school where they imbibe the traditions of the service at an early age, but it seems to me that this exclusiveness can be carried too far. In my opinion, if capable enlisted men fit themselves for a commission, or if young gentlemen educated at their own expense in civil life are thoroughly competent to fill positions in the service they should be given an opportunity to do so. The graduates of the Naval Academy, in any case, would have a tremendous advantage over any others in their early connection with the service, and if civilian applicants, or applicants from the ranks of the enlisted men, come in fair competition and stand ahead of any of the graduates they certainly should be entitled to appointment. There would be the additional advantage in drawing officers from these various sources, that it would prevent graduates of the Naval School from regarding their diplomas as a patent of nobility, and would impress upon them the fact that cultivated brains have the same value whether coming from Annapolis or any other institution of learning.

Coming now to the plan proposed by Mr. Bennett, of practically making the service an engineering navy, I may say, that in general, I am inclined to favor the plan. He does not go sufficiently into details of the performance of duty on board ship to enable me to say that I would agree with the plan in every particular, but it strikes me that it is in the line of the general progress of the day.

In fact, it seems like a fulfilment of the prophecy of the late Gustavus V. Fox, Assistant Secretary of the Navy, who said that the time would come when the engineer would swallow the sailor or the sailor would swallow the engineer. The late Admiral C. R. P. Rodgers also frequently urged upon young line officers the importance of studying engineering in order to maintain the prestige they had so long held.

We all know, of course, the history of navies, how in the early days there was a division between the men who did nothing but fight and who were actually soldiers embarked for the campaign, and the men who managed the ship and caused its propulsion. This was distinctly the case in the galley period, and was also the case with sailing vessels up to a date not so many hundred years ago. After that time, however, a change came about whereby the sailor added to the work of propelling and handling the ship, the duties of the soldier, and we then had the Navy of about 100 years ago. With the advent of steam, the differentiation of duties again came about, because the new element required specialists for its successful use and they could only be obtained outside the service. With the progress of naval design and the gradual disappearance of propulsion by sails, we are coming back to conditions very similar to those of early times where one set of people will be soldiers and the other set will look after the propulsion of the vessel.

It would seem, therefore, that Mr. Bennett's proposition, which is practically to make every officer an engineer primarily, adding to his training

as an engineer those parts of seamanship, navigation and gunnery which will enable the vessel to be handled in any weather and manœuvred in time of action, will be repeating the line of progress which history shows us has already been productive of good results.

I cannot agree with him, however, in his suggestion for reform of the course at the Naval Academy, both with regard to reducing the age for entrance and reducing the requirements of the curriculum. It seems to me that boys of 12 or 13 years of age are too young to be sent away from home, and also that an entrance age of from 15 to 18 would meet the requirements better. Then, with regard to the course of study, I fear that he has carried the utilitarian idea of education too far. As a practical man myself, and a member of an intensely practical profession, I am strongly inclined to avoid letting education run to mental training pure and simple without regard to its ultimate utility; but at the same time we must remember that the object of education is not so much to teach a man definite facts as to train his mind so as to enable him to meet the problems which come upon him in after life, and therefore it seems to me that it would be unwise to reduce the requirements of the course at the Naval Academy much below what they are at present.

His suggestion of offering special facilities to officers who are to go into what he calls the Corps of Naval Engineers, for attending colleges and scientific schools where they could secure more advanced instruction than is possible at the Naval Academy, strikes me as a very good one. I am also pleased with his suggestion that, if his plan is adopted, officers from the Ordnance and Construction branches of the Corps of Naval Engineers should go to sea. I have always been a great believer in the fact that people who have to do with the designing or building of any part of a ship or its equipment should have personal acquaintance with their creations while they are in actual service.

As I have already said, I am strongly inclined to favor Mr. Bennett's plan for an engineering navy provided the details of the scheme can be worked out satisfactorily; but it strikes me that one point must not be overlooked. The duty of officers should be so arranged as to keep up their efficiency as engineers; in other words, if an officer should be detailed for long periods as a pay officer or deck officer he might lose touch with engineering. Engineering is a growing profession in which there is constant change and for a man to remain proficient he must devote a great deal of attention to it. This, however, is a matter of detail which could be worked out if the general scheme met with sufficient encouragement to make it worth while to submit it to the proper authorities for carrying it out.

As I said in the beginning, I approve most heartily of the sentiment which prompted the writing of the essay, and I trust that every officer in the service will be actuated by the same motive, and will do his share towards bringing about that harmony which would raise the efficiency of the service to a maximum.

Commander G. H. WADLEIGH, U. S. N.:—The essay of Passed Assistant Engineer Bennett appears to be another very ingenious scheme (of which there are now so many) to increase the land Navy.

The main points of the essay to be commended are, to make more room on board ship by leaving paymasters and chaplains on shore, to equalize the pay, and the rather remote suggestion to promote enlisted men to commissioned officers.

The essayist recognizes that the chief reason for a navy is *war*, but fails to add that it is war *at sea*, and falls into the common error of confounding officers of the Navy with naval officers; the former can be made to order, by act of Congress, but it takes something more than an order to make the latter. A naval officer must be a seaman, and no way has yet been devised to make seamen on shore; a man may go to sea for a lifetime and not be a seaman, but if he is without sea experience it is fair to assume he is not a seaman, therefore cannot be a naval officer, and yet it is seriously proposed in this essay to consolidate, into practically one body, all the officers of the Navy who rarely or never go to sea, which conglomeration is to be the *corps d'élite* of the Navy.

When such a *corps d'élite* is so composed, it will be necessary for naval officers to ask, "Where are we at?"

Chief-Engineer H. WEBSTER, U. S. N.:—While agreeing fully with the writer of this paper in the position that the end in view by all well-wishers of our Navy is greater homogeneity, my experience in the service, extending over many years, does not excite the hope that the remedies for our ills, suggested by Mr. Bennett, can ever materialize.

I think the natural bent which will induce one man to become an engineer, another to deal with the paymaster's duties, and still another to prefer the duties and authority of the deck-officer, will continue to create the same amount of friction, and on pretty much the same lines as at present.

The position taken by Mr. Bennett, that the chief reason for the maintenance of a Navy is war, is true, but with limitations. And it is just as true that the crew, used in its broadest sense, of a man-of-war, are fighting men. Even the chaplain, man of peace as he is, strengthens the fighting capacity of his ship by the consolations given to the sick and dying.

In other words, there are no non-combatants in the ship, but all, whether bearing a sword or a scalpel, are fighting men.

The position relative to the age limit for admission to the Naval Academy is sound, and a modification of existing law is called for.

I am of the opinion, however, that the two years spent in cruising ships before attaining a commission is an unnecessary enlargement of the probationary term.

I believe better officers will be furnished the Navy if the four-year period is the only one required of the cadet before reaching his full official status.

Place a boy at the Academy when fourteen years old, and if by the time he has reached his eighteenth year he is not fitted for a commission I doubt if he ever will be.

The preparation proposed in this paper for more efficient grappling with the naval life, by the somewhat startling method of devoting every other afternoon to recreation, boating, ball-playing, etc., is directly in line with the practice in our best civil colleges, and the increased vigor and health resulting from these practices would, I am confident, enable the cadet to more than make up the time so disposed of, and the outcome would be beneficial.

The projected "Corps of Naval Engineers" does away with the necessity for such extended shore duties as are at present enjoyed by sea-going engineers, ordnance experts, and others of the actual fighting navy, and, *if practicable*, might solve many questions now bothering the heads of Bureau chiefs and detail officers.

Mr. Bennett's suggestions on the question of numbers of officers required for efficient service afloat must strike the average thinker as a step in the right direction.

To those in the Navy who have come in contact with the men-of-war of foreign countries, the disparity in officers oftentimes appears ridiculous.

The proposition to do away with the rank and title of commodore is one not likely to find much favor in the Navy.

Really the most intricate part of the reorganization proposed by Passed Assistant Engineer Bennett is that relating to pay.

It is this question, misunderstood as it generally has been, which has been the stumbling block to legislation for many years, in fact ever since the introduction of line and staff distractions, and all attempts hitherto made to bring the vexed question into line with reason and common sense have failed, and I fear are likely to meet a like fate in the future.

Personally, I am quite ready for any reasonable change whereby rank and pay will be approximately synonymous, but I fear my position is held by a small minority.

The feeling in the Navy, in a general way, is, "compromise on titles, rank, duties, but let our pockets alone."

In concluding this somewhat desultory criticism of Mr. Bennett's excellent paper, I desire to express the opinion that it contains more points of interest, and greater reasonableness than any of the numerous naval programs which have been presented during the last twenty-five years.

Lieutenant W. L. RODGERS, U. S. N.:—This paper is a most timely one: it cannot be more than a few years before something radical will be done, and it is well to have the ground thoroughly examined before being forced to the leap.

The gist of the paper is, that for real efficiency, the number of corps going to sea must be reduced, and that the staff officers must be dimin-

ished in numbers and confined more to general administrative work at the Department, and at navy yards. These proposals seem so evidently necessary, that their interest lies more in the details of application than in the principles themselves, so I shall try to indicate some points where the proposed scheme does not seem thoroughly elaborated.

In regard to the Medical Corps, the principal point in which a surgeon in the Navy differs from a medical man in civil life is overlooked. The conditions of civil life are such, that a man must seek practice in order to acquire skill and reputation ; but in the Navy it is the duty of a surgeon while at sea to use his skill to avoid further practice. I mean that by following sanitary precautions, he must ward off disease as far as he can, and if by chance he has some serious case, his duty to the patient and to the Navy, is to get the man out of the ship and to the nearest hospital. Thus a cruise at sea, which to other naval officers affords professional practice and improvement, offers rather an absence of it to surgeons. All the Navy can therefore join heartily with the Surgeon-General in his efforts to afford surgeons ample opportunity for study and practice in the great cities.

We now come to the main part of the paper, purposing a consolidation of the staff-corps. As I understand the proposal, it is to greatly diminish the number of staff officers on shipboard, keeping only a few at sea in order that they may gain practice which will make them more useful in their office work on shore.

In other words, the staff-corps should belong to the Navy Department rather than to the naval forces.

It is an interesting question to discuss how far the constructive duties of the Navy Department call for the highest technical originality in the responsible officers at the heads of Bureaus. While all navies find among their officers more or less technical skill in building and designing, it seems an admitted fact that the milestones of progress are set up by private firms. The technical corps of navies follow the lead of private industry. Therefore, I cannot approve of a too highly specialized corps, either for construction, engineering or ordnance. What the Navy needs to build its ships is a body of shrewd critics, whose technical education and practical experience at sea shall enable them to choose wisely among novelties, and who shall be conservative and sure when they themselves are called upon for designs and plans.

The present Bureaus of Ordnance, Equipment, and Steam Engineering might well be imitated by the Bureau of Construction in its organization. Their duties have been well performed in the past, and it is largely because they have been content to follow well established precedent while keeping up with all improvements. The constant change in the officers assigned to these duties prevents the Bureaus from falling into a rut, and the practice at sea gives sound judgment. All these advantages would be sacrificed were the corps of these Bureaus to be made small permanent ones, with little experience at sea.

A permanent corps pleases itself only in its work, while as now organized the Bureaus are more in accord with opinion in the service, and so resemble private firms in seeking to give satisfaction to those who use their product.

Therefore, it appears that to organize properly the constructing force of the Navy Department, there should be an Admiral in general charge of all the technical Bureaus to harmonize their views, supervise their work, and see that their designs are acceptable to the professional opinion of the service.

The Bureau of Ordnance should remain unchanged. The Bureaus of Supplies and Accounts, of Steam Engineering, and Construction each should have a very small corps of officers chosen from the line of the Navy not less than ten years after graduation. These officers should be liable to sea service in their special branches until twenty-five years after their graduation. Both ashore and afloat their duties should be in line with their specialties, and the Chiefs of the Bureaus should be selected from the corps for four-year terms. Their services in their specialties should be supplemented by those of as many junior line-officers as seem advisable. There should be about 50 engineers, 30 paymasters and 15 constructors. This would be a sufficient number to put specially trained people in all the important positions, and their juniors detailed from the line would be most efficient practical assistants.

As for the corps of mathematicians, there seems little reason for it. Mathematical talent is needed and found in every corps, and the advantage of assembling it in one body is not manifest.

The corps of civil engineers is unnecessary, too. The care of the navy yards should be assigned to officers of administrative ability, who can get their money's worth out of the appropriation. The Department should employ at an annual salary some distinguished firm of consulting engineers, whose advice on important questions would be far more valuable than that of the present corps of civil engineers of the Navy, who do not have much practical experience in important works. In this way the Department would follow the methods of successful business men.

In general, I agree heartily with the essayist's opinions, and wish to point out in particular, that the Navy does not need to include among its officers people of the most distinguished technical attainments in constructive branches. For that, we should depend on the general industries of the country, and the special corps of the Navy will amply fulfil their functions if they are able wisely and promptly to avail themselves of the ingenuity of others.

Passed Assistant Engineer W. F. WORTHINGTON, U. S. N.:—The essayist is to be congratulated upon having propounded an excellent solution of the problem "how to radically change and greatly improve the organization of the Navy without materially disturbing vested interests."

The ideal fighting organization is one where each man can in an

emergency do the duty of any other. This ideal was nearly attained in the old sailing war vessels. With the introduction of steam came a body of men who were so taken up with their special work as to be available in only a very limited degree for military service. But the trouble did not stop here. The mechanism of the gun rapidly developed in complexity; the steel hull caused an increase in the complexity of the compass and necessitated an expert to do the navigation; then the hull has been so closely calculated and so nicely adjusted to its purpose that slight changes of normal conditions may be fatal to safety, and the commanding officer must be something of a scientist to be able to understand how and to what extent the stability, manœuvring qualities, etc., will be affected when compartments are pierced by gun, ram or torpedo. Finally, the paymaster's duties have developed to such a degree that considerably more than one-fourth of the latest edition of the U. S. Navy Regulations is devoted to that department. Thus we see the modern ship rapidly dividing into groups of specialties, and the house becomes more and more "divided against itself." Each group has duties alternately on sea and shore. I understand the essayist proposes to divide the naval force in a different manner. To group the sea-going force and shore force separately. To make the former as homogeneous as possible by training them to each others' duties. The time heretofore spent on shore duty to be devoted by each specialist to work outside of his specialty, but inside the limits of the ship.

In my opinion this would greatly increase the efficiency of the ship, but might reduce the efficiency of the constructing corps, as they would lose touch, to a certain extent, with the others. However, as the war-vessels of all civilized and semi-civilized nations are, class for class, very nearly equal in fighting power, if the numbers engaged on each side are equal, the result of battle must depend almost exclusively upon the skill and knowledge of the officers and men, and the harmony with which they work together.

The promotion of harmony and homogeneity in the service can be best begun by training the largest possible proportion of officers together at the Naval Academy. The essayist is right in saying, "there is a prevailing opinion that the Naval Academy is running too much to theory." While there may be some foundation in justice for this opinion, it is largely based upon a mistaken notion that the cadet graduates when he leaves at the end of the four years' course. As a matter of fact, his education is supposed to go on for two years longer and he should get the greater parts of his practical training after leaving the Academy. Admitting, as I do, the desirability of lowering the age of admission, it would not be necessary to change the present course of studies. Experience shows that a few years difference in age does not make any appreciable difference in a boy's ability to learn. Or, to express it in another way, it is not found that on an average the older cadets stand higher than the younger ones. I believe statistics have been collected on this subject and go to show that the younger ones rather come out ahead. The pressure brought to bear to

continually increase the age of admission comes from outside. The lower the age limit the greater the restriction upon members of Congress in their choice of candidates for appointment. This bears particularly hard upon Representatives of districts where the standard of education is low. Carefully scrutinizing the course of study at the Naval Academy, taking into consideration the relative amount of time devoted to each study and to practical exercises, I do not find much that is superfluous, and even if studies of doubtful utility were dropped the amount of time gained would not be great. In deciding upon a course of study it must always be borne in mind that every member of a class will not remember everything he learns. Some margin must be allowed for what will be forgotten. Also, intellectual exercise develops the intellectual powers, correct reasoning, quickness of apprehension, and a high standard at the school weeds out those whose minds are so defective or so slow that they would not be likely to make good officers.

Turning now to the two years spent by cadets at sea, that time is almost entirely wasted. The cadet learns little that is new, any duties assigned to him are of the most rudimentary character, and altogether he may be considered to have done well if he has not forgotten more than he has learned. Here, then, is the chance for improvement. Let all cadets spend their two years in one ship provided for the purpose. Have a program made out on the same general plan as that for practical exercises at the Naval Academy, and arranged so as to cover a period of about eight hours per day for the two years. Turn the ship over entirely to the cadets who would be required to fill, in rotation, all the positions of officers and petty officers, and to carry out the program to the best of their ability without advice, assistance or criticism. The minor positions, seamen, landsmen, firemen, etc., should be filled by an ordinary crew. Commissioned officers should be present solely for the purpose of marking the cadets for their proficiency and to prevent any *serious* injury to vessel or machinery. They might give advice out of drill hours if called upon. The class standing at final graduation should depend entirely upon the proficiency displayed during this two years at sea, the multiple given at the Naval Academy being thrown out. Provision for leisure and recreation is purposely omitted from this program. Graduates from the school are sound and strong in physique, well developed mentally and accustomed to work. Relief from academic duties, and the pleasure of occupying positions of trust, with opportunities for testing their skill, would make the cruise attractive for all who had a natural aptitude for sea life. Handling firearms, rowing, sailing, working machinery, drilling are all amusements that American boys take to as naturally as a duck to water.

A cruise of this kind, properly planned, would afford a scope for the exercise and development of all the literary and scientific knowledge acquired at the Academy which had any bearing on naval duties.

The education of specialists could be best continued at the constructing yards.

While agreeing, in the main, with the idea of separating, at an early date, the sea officers from what the essayist calls the Corps of Naval Engineers, I do not think any of the latter should come on board again in a position of authority, *i. e.*, as "chief engineers of large vessels." With the good grounding in the elements of engine and shipbuilding, etc., which all naval officers should have, those who had spent their lives at sea would be more competent to do any duty that might be required.

The introduction of officers not personally intimately familiar with working methods on ship board would be an element of discord. They might come occasionally for the purpose of making observations and familiarizing themselves with the working of new machinery, apparatus, etc.

All the sea officers being well instructed in theory, and trained in the practical use of everything on the ship, their regular reports, accompanied by reasons and arguments, would furnish the designing corps with the knowledge they would require for making alterations, improvements, etc., and serve to keep the two branches somewhat in touch.

The Naval Institute is fortunate in being able to bring up such an important subject for discussion, and in having it presented in a form which admits of ample treatment without hurting any one's susceptibilities or stirring up animosity, and I hope many of the members will seize this opportunity of making known their views so that a good idea of the general opinion of the service may be obtained.

Lieutenant-Commander J. G. EATON, U. S. N.:—The plan proposed contains many features which would tend to the greater efficiency of the personnel, and in so far as it serves to correct evils that are acknowledged by line and staff alike to exist, it merits the support of all. In venturing criticisms upon some of the details, I do so in the hope that the essayist will show us more clearly than now appears the reasons which have influenced him in his recommendations.

It is hard to resist the fascination of setting another's house in order, but I shall endeavor to withstand the temptation and offer hesitatingly any views which concern the staff.

The necessity of commissioning junior surgeons as full lieutenants does not appear. The custom of naval services that all officers should begin their duties in subordinate commissioned grades is founded upon just, military principles. No reason is given why surgeons should be exempted from the lot common to all, and until some valid cause is stated, the present system answers.

I fail to grasp the essayist's meaning when he states that "the present status of the medical corps is a compromise between the two conditions just described," and "is unsatisfactory to all concerned, as everybody knows." If the naval medical officer of to-day is not "an officer in fact as well as in outward appearance," I am at a loss as to what constitutes an officer. Webster defines an officer as "a person holding a commission

from the President of the United States, or the governor of a State." Our medical officers possess this requisite. They are subject to all the responsibilities and enjoy all the privileges of other officers. What then is the meaning?

The question of titles is quite another matter. A title should define the character of the duties for which the officer is commissioned. If it would conduce to the effectiveness of the surgeons to be called "Surgeon-Lieutenant, Surgeon-Lieutenant-Commander," etc., by all means let them so be designated. When, however, we read as recently on the death of one of diplomats in Washington, that, "every possible attention was rendered the dying man by Colonel this, Major that, and Captain the other, one wonders why a man with a fractured skull was left to the ministrations of unprofessional men, when a surgeon was needed. Afterwards, in learning that the Colonel and his confrères were surgeons masquerading as killers, not healers, the mystery is solved. I believe that this question can be safely left to the decision of the surgeons themselves. The chaplains can, with profit to the service, be assigned to duty ashore. On board ship he frequently brings the sword of discord, rather than the peace which passeth understanding.

The reduction of the age limit on entry to the Academy is most desirable. The Chief of the Bureau of Navigation has already recommended that the age of admission be fixed between fourteen and sixteen years. A change in the scope of the curriculum would follow naturally.

The appearance of the cadets fresh from the Academy does not indicate that they have suffered from lack of recreation periods, and it should not be forgotten that book studies practically cease from June to October.

I differ radically from the conclusions as to the course to be followed in the two probationary years at sea, before final graduation. In these years the young cadet acquires his first real knowledge of discipline and command under existing (not theoretical) conditions. "The proper study of mankind is man" applies with peculiar force to the naval officer. This study cannot be pursued at the Academy, nor can it be learned from books. The importance of the knowledge of men can hardly be overestimated. Therefore, as soon as the cadet leaves the school-room, give him every opportunity to handle men. Let him perform all kinds of practical duty, let him master the art of executing difficult orders, and let him feel that even more depends upon his aptitude in these essentials than on the neatness of his note-books. Mark him upon his quickness of perception, readiness, zeal, and willingness, and have these marks count equally with his previous records as a scholar. He has already shown what his capabilities are as a student; use this sea-record as a test of his efficiency as an officer.

The plan proposed for the formation of what the essayist terms an Engineer Corps, or "corps d'élite", contemplates the reduction of many corps to a single one, apparently homogeneous. This homogeneity consists more

in carrying its members on one list than in the performance of similar duties by its occupants. Each set of officers in this corps will be pursuing different lines, and each officer will be most interested in fitting himself for service as Chief of his specialty. Line officers would protest against the Chiefs of Ordnance and Equipment being always selected from a body of men whose sea-going was a thing of the distant past. The proposition to allot six of the Bureau Chiefs to this shore duty corps does not commend it to those who still believe that the real Navy is the part afloat.

I must protest against misnaming any such body a "corps d'élite." If the officers who are charged with the responsibilities of upholding the nation's honor, who encounter the hardships, and brave the dangers of storm, fever, riot and combat are not the élite of the service, then can no body of officers be so entitled. The designation of any set of officers who perform none of the arduous duties as a "corps d'élite" is more than a perversion of terms, it is an outrage. The point here presented may seem trivial, but on it hinges a great principle which is being relegated to oblivion. The whole tendency of the past fifteen years is to exalt the specialist, and contemptuously ignore those whose qualities fit them for service afloat. The élite of the Navy should be composed of officers who can and do manœuvre ships, command men, and possess practical quatities which render them quick and decisive in action.

In the advantages claimed for the proposed reform, conclusion No. 1 is conceded. I do not appreciate the advantages to be gained by Nos. 2 and 3, except in very special cases. The immediate result would, I believe, follow the custom in other navies. Sea-going officers would consider that the science of ordnance and machine construction was a thing apart from, not a part of, their profession, and I doubt that the gains from specialized knowledge would compensate for the apathy and ignorance of those shut out from participation in the preparation of war material.

The simplification in conclusion No. 4 has been touched upon. Conclusion No. 5 appears to be practically the same as No. 4. Conclusion No. 6 marks the goal to which all efforts are directed. I regret that I cannot believe that the plan proposed will insure the attainment.

The essayist has seized upon the real difficully in the present organization of the Navy, viz., the multiplicity of corps. I am in thorough accord with his diagnosis of the evil, though I cannot follow him in his method of reform.

Lieutenant W. F. FULLAM, U. S. N.:—Mr. Bennett's paper is very interesting. With its main purpose—to advocate a reform "which will merge the present official body into a homogeneous whole"—all who have a true interest in the Navy must be in accord. There is room, however, for considerable difference of opinion as to the best way to accomplish the object in view.

Undue sensitiveness exists, and unnecessary irritation has been caused by the use of the term "non-combatant" in the Navy. As a rule, it has

not been used with any intention of casting reflections upon those to whom it was applied, but simply to distinguish those individuals on board ship who ordinarily have no duty in connection with guns, torpedoes, explosives, or with the military manœuvres of ships or men. This may be a misuse of the word, but it is not easy to find a word that will answer the purpose any better. Mr. Bennett is quite right in insisting that this term be used with more care. As a fact, there are fewer non-combatants afloat than ashore, because, as has been well said, "There is no *rear* on board ship."

I must disagree entirely with Mr. Bennett as regards the present status of naval surgeons. Every surgeon is to-day "an officer in fact as well as in appearance." Nothing more is needed to fix his official status. His rank is as real, as absolute, as that of any line officer, because the term "relative rank" means "equal rank"—perfect equality. There are not two distinct kinds of rank in the Navy. There is no such thing as "positive rank" in the statutes. This term has been coined, and from this has proceeded the false theory that "relative rank" is an inferior kind of rank. And again, the provision in the Revised Statutes that staff officers shall not exercise "military command" has been absurdly misconstrued. It has been claimed that, by this provision, a staff officer has no *military authority* over his men or his department! This is not what the statute means at all. It simply means that a staff officer shall not exercise "command" of a ship or naval station—exclusive, or independent command. In this case the term is used in a restricted sense—in the sense that there is but one officer on board a ship who is exercising "military command"—the captain. *No other line officer* is exercising "military command" on board that ship. The staff officers on board have exactly the same status, the same military "authority" *in their own departments*, that the line officers have in their divisions. Unless, therefore, staff officers aspire to the command of ships or naval stations, they have no reason whatever to complain of their status as to rank and command.

It is perfectly possible to carry out Mr. Bennett's proposition that line officers shall do the duties of pay officers. They should do these duties ashore as well as afloat. They are well acquainted with the needs of the Navy, and are more familiar with the material that is required than are officers who come from civil life. A graduate of the Naval Academy can easily be made acquainted with the business and bookkeeping methods required, since young men from civil life, with little previous experience, have mastered the subject in a short time. There is no logic that can defend the policy of appointing paymasters from civil life, while we are discharging from the Navy every year young men who have been trained for six years at great trouble and expense to the government, and whose education would make them much more useful, particularly on board ship.

Mr. Bennett's treatment of the Engineer Corps question is disappointing. The best and surest way to make the engineers contented with their lot is to relieve them from engine-room watch and restrict them to the

work of designing, superintending, and constructing machinery. The duty of running engines should be given to a corps of warrant officers recruited from the engine-room personnel, a policy that would vastly encourage and increase the efficiency of the latter.

The work of designing and constructing a ship's hull and a ship's machinery should be in the hands of *one* corps instead of two. The work would be done more expeditiously and more economically. This fact suggests the merging of the two corps of naval constructors and commissioned engineers. This corps of officers would be charged with the scientific engineering and constructing work ashore as well as afloat. About one-third of these officers should be afloat and two-thirds on shore, one or more being assigned to each ship as superintending engineers. In this manner the officers charged with the work of constructing and designing ships and engines would get the practical experience at sea that would be invaluable to them. The principle of homogeneity is better secured by this plan than by that proposed by Mr. Bennett, and it is submitted that more attention is given to the practical considerations involved.

I cannot agree with Mr. Bennett's treatment of the Marine Corps question. It is an important matter and should be handled with strict regard to present service conditions and requirements, and with no carelessness as to facts or statements. It is hardly fair to say that the marines have borne "their full share of the toils and privations of the service without reaping a proportionate share of the glories, etc." Their "toils and privations" have been *infinitely less* than those of the blue jackets. They have never known the drudgery of coaling or cleaning ship; their duties have always been of a much more agreeable nature, and they have always been put to the front upon occasions of ceremony and have been praised to the echo. And it is a very extravagant use of language to say that the corps "is a model of military discipline," in the face of the official statistics which show that during a period of ten years (from 1882 to 1891) the desertions in the marine corps averaged 25 per cent. annually! When 25 men out of every 100 in an organization desert annually, the discipline cannot be good. It is ventured that no corps ashore or afloat in any army or navy has a worse record in this respect. Such a corps is too unstable to be efficient in a modern navy. An officer who inspects the cramped living spaces on board a modern fighting ship, and who gives intelligent and conscientious consideration to the question of the number of *working men* who are needed to coal ship, and keep the ship in proper condition, cannot, without doing violence to his professional reputation, justify the retention of men who do not work *when working men are most needed*, whose duties are circumscribed within narrow limits, and who are untrained in a naval sense. The principle of "merging the present official body into a homogeneous whole," which Mr. Bennett puts at the foundation of his essay, is directly violated by retaining two distinct military organizations, and two distinct kinds of fighting men in the Navy. In fact,

homogeneity is discarded at the most vital point, and where it could be most easily realized. The time has come when a battleship, to be most efficient, must be manned by a "homogeneous crew of the seaman-military class," every enlisted man doing his fair share of the drudgery, and the petty officers having the status of the non-commissioned officers of an army.

In common with many other officers, Mr. Bennett's criticisms on the Naval Academy are due, in some degree at least, to an erroneous idea as to the theoretical and the practical features of the present course of instruction. The sciences and higher mathematics are not exhaustively treated. Not much more than an elementary knowledge of these subjects is required. Differential and integral calculus are finished in four months, least squares in one month, and mechanics including strength of materials in about six months. There is no profession in which sciences and mathematics are more directly involved than in the profession of a naval officer. In this scientific age it would be a disastrous step to the rear to curtail these subjects at the Naval Academy. A knowledge of, or a grounding in, the elements of these things will not make an officer less *practical*. On the contrary, he may be all the more practical if the ground-work of his training is broad, and he will certainly be better prepared for the duty that often falls to the lot of a naval officer. There are plenty of boys in every congressional district who can attain the desired standard. There is no necessity for lowering it. In time of peace it is well that all scientific work in connection with the Navy should be performed by naval officers. Mr. Bennett says "the scientists will develop themselves as they are needed." It seems to me that it would be more sensible to expect an officer to *develop himself* in the ordinary every-day routine duties on board ship, than to expect him to *develop himself in a science* in which he may not have been grounded while young. One requires observation, the other requires study. The best time to study is while young and at school. Mr. Bennett says he would have the two years at sea "devoted to a systematic continuation of the instruction of the cadets, rather than to an attempt to exact the performance of responsible duties from them." It is submitted that this requires study under conditions where study and "systematic instruction" are least practicable, and it deprives the cadet of the opportunity to gain practical experience when he could best do so. This is putting the cart before the horse. The Naval Academy is the place to study and to receive "systematic instruction." It is the only time and place where any *system* of education can be successfully carried out. The ship is the place for practical experience, and every cadet should be given "responsible duties" as soon as he graduates.

The system of physical training, and the present physical condition of the cadets, could with difficulty be improved upon. In this respect there is no naval academy in the world that excels ours. The practical instruction is progressive, thorough and complete in nearly every department,

great improvements having been made in the past ten years. It is more than probable that any attempt to revolutionize or radically change the system of naval education in this country—a system that has been developed with great care and with an intelligent appreciation of modern naval requirements— would prove to be very disastrous. There is no part of our naval establishment which has kept up with the times better than the Naval Academy.

A few changes might be advantageous. Candidates should enter between 14 and 16. The course should be five years instead of six, four years and six months being devoted to the present course of study, and during the last six months the whole 1st class should be sent on board a modern ship attached to the Academy, and thoroughly instructed in all the practical features of ship routine. After graduation the cadets should be commissioned as ensigns at once. Their studies should cease, their "responsible duties" should begin. If our naval officers are not properly trained to-day, *the fault does not lie at the Naval Academy*. It is not possible to take boys at a low standard of admission, who come from all parts of the country, and from all classes of society, and make finished practical naval officers of them in four years. It would be quite as reasonable to expect that a graduate of a law school should be immediately competent as a judge of the Supreme Court. It is the function of the Naval Academy to give the cadet a thorough preliminary education; it is the business of the naval service to make him a practical naval officer. The Academy cannot do the work that properly belongs to the service, and the service will fail miserably if it attempts to do the work of the Academy. The latter does its duty well; let the service do its part, and it will be found that the officer who is well educated in the beginning will render a better account of himself than one whose scientific and mathematical training has been curtailed with the hope of making him more practical. There are certain professions that demand a collegiate education. The profession of a naval officer is one of them.

To attain the object sought in Mr. Bennett's excellent essay—to "merge the present official body into a homogeneous whole"—it is submitted that the following corps of commissioned officers are all that are needed:

1st. Line officers, to do their present duties and the duties now performed by marine and pay officers.

2d. Engineers (or constructors), to do all the duties in connection with the design, building, and superintending of ships' hulls and machinery.

3d. Medical officers.

4th. Chaplains.

All these officers *should have sea duty* in their regular turn. There should be no other distinct corps or classes of commissioned officers. A sufficient number of warrant officers should be maintained to do subordinate and practical duties.

Lieutenant J. B. MURDOCK, U. S. N. :—Mr. Bennett's essay is a valuable contribution towards a vexed and much debated subject. As the Naval Institute exists for the discussion of matters of interest or utility to the naval service, nothing can be more proper than a paper on the reorganization of the personnel, and at the present time nothing can be more opportune. Mr. Bennett temperately and courteously advances ideas which he probably knew would provoke discussion, and if this is carried on in the same spirit much good may result to the Navy at large.

The essayist's leading principle that "the chief reason for the maintenance of a navy is war" is beyond criticism. His second theorem that all officers of the Navy with the exception of surgeons and chaplains shall be graduates of the Naval Academy, with the possible exception of future legislation authorizing advancement of enlisted men, will probably meet with general approval. The Academy course can easily be arranged to supply all the fundamental training necessary, and to inculcate habits of study and investigation, leaving the active service after graduation to supply the practice which alone can perfect a naval education.

The suggestion is made that the Academy course should include bookkeeping, but it is an open question whether a knowledge of the subject, as practiced in civil life, will be of any assistance in mastering the complex system of accounts at present followed in the Navy. It might, however, be instrumental in finally leading to the adoption of some system which, while providing for all necessary accountability for government property, would permit the fitting of vessels and the supplying of stores to be conducted with something of the certainty and celerity necessary for the military efficiency of the service.

I am compelled to first differ slightly with the essayist in his remarks on the status of medical officers. While cordially concurring with all he says as to the importance of the duties performed by the officers of the medical corps, and to their just claims for proper rank, dignity and emoluments, I am unable to see the necessity of any such special recognition as is involved in appointing them to the service with the rank of lieutenant, which is attained by other officers only after long years of service. This is not rectifying an inequality but creating it, and it is certainly unjust to bestow extra rank on any one corps, be it medical or any other. The proposed change of title from Assistant Surgeon to Surgeon-Lieutenant does not commend itself to me, as it violates the oldest traditions of our Navy and also the prevalent practice in all leading navies of the world to-day, of giving to each officer a title which designates his general duties and position in the service. The position of surgeon and the honor appertaining thereto would seem to be self-evident, and the addition of another title, rightfully belonging to a grade having radically different duties, cannot assist in defining the position of the medical officer with greater exactness.

I am absolutely opposed to the creation of any "*corps d'élite*" as outlined by the essayist. Nothing, in my opinion, would so completely block

all improvement of the personnel as the division of the officers of the Navy into two classes ; one, ostensibly scientific, the other, presumably practical. A system similar to that proposed is in vogue in our Army, and is, in the opinion of most observers, productive of more jealousy and friction and less efficiency than any other in existence. It is unquestionable that, from a scientific point of view, better results may be attained by the separation of a body of officers who have shown aptitude for scientific work, but our naval science is of use to the country only as it assumes a practical form. To quote the essayist himself,—"extensive knowledge of interior ballistics and thermodynamic functions is a good thing in its way, but is not of much application to the duty of keeping a gun-mount or a triple-expansion engine in a state of ready efficiency."

In order to properly manage the complex mechanism of our men-of-war, officers require thorough instruction in scientific principles, but must apply them practically. I believe I am safe in making the assertion that, in the reconstruction of the Navy within the last ten years, the best work in construction, in steam engineering, and in ordnance has been done by officers who were not only conversant with the scientific standing of their subjects, but who also knew by service on shipboard how to best apply their knowledge in practical form for the good of the service. It is unquestionable that the detachment of an officer from shore duty may occasionally cause an interruption in some important work on which he has been employed, but the detached officer retains his knowledge, while his successor soon masters the situation and eventually advances the work. Sea service is deadening to many of the intellectual faculties, but if an officer has developed any special sphere of usefulness, he retains his knowledge, while his life on shipboard keeps him in close touch with the practical part of his profession, and develops his usefulness as a member of the Navy, which exists, not for scientific development only, but for "war."

Another objection to the "*corps d'élite*" is that it interferes with the benefit resulting to officers individually from shore duty, in which the designing or preparation of material for service confronts them continually with new problems which act as a strong stimulus for the acquisition of professional knowledge. This education is most valuable, and, when officers rotate on duty ashore and afloat, becomes widely disseminated throughout the service, materially promoting the average knowledge and usefulness of the personnel. The continual change of officers on shore duty, involving design or fabrication of material, may be occasionally objectionable, but, on the other hand, the continual addition of new blood effectually breaks up all stagnation, prevents administration falling into stereotyped routine, and rectifies mistakes.

With a "*corps d'élite*" in charge of all important shore duty, the greater part of the officers of the Navy would be completely shut out from all work calling for any intellectual activity and certainly deteriorate. The corps itself, being out of touch with the practical workings of the service,

and with positions secured for life, would slowly lose zeal and interest in its work, and would lose the practical knowledge of the requirements its work should fulfill. It would inevitably increase clerical and "scientific" work at the expense of practical, and, by its failure to meet the actual wants of the Navy, together with the many privileges it possessed, would create heart burnings and dissensions, in comparison with which those now in existence would be insignificant.

My final objection to the proposed corps is that it is essentially a peace institution. The efficiency of the Navy, for its ultimate purpose of warfare, will be the greater the more of its officers are trained aboard ships. The many questions of interior administration and discipline, of practical steam engineering, ordnance and equipment, which finally determine the efficiency of the service can never be mastered ashore, and every officer assigned to permanent shore duty is half lost to the Navy, in addition to having his practical usefulness ashore impaired by the inevitable tendency toward the acquirements of clerical methods of work in place of military.

Following out the essayist's precept that the Navy exists for war would inevitably lead to the abolition of professors of mathematics and of civil engineers. They have increased from small beginnings to corps whose numbers, rank, and pay seem to be out of all proportion to the importance of the non-military duties they are called upon to perform. They would have no position in a war organization, and in peace such of their duties as are of importance could be performed by officers of other corps. The duties of the pay corps are not beyond the abilities of educated men, and I am glad to be able to agree with the writer in his proposal that they should be performed by officers of other corps detailed for the purpose. The duties of the engineer corps are, however, of so important a nature as to render its retention advisable. A small number of scientists would probably suffice for all its necessities, but the demand for practical engineers, thoroughly posted in all technical detail of marine engine construction, management and repair will increase from year to year as the machinery of our ships becomes more complex. The practical knowledge required is so extensive as to be attained only by wide experience, and the endeavor to have line officers become good engineers in addition to retaining usefulness in their present duties would result in indifferent results in all branches of work.

I confess to an inability to comprehend the necessity for transferring the titles of the line to any other corps, while begrudging no officer whatever measure of rank or dignity may be necessary to endow him with everything necessary for the proper performance of his duty. The officers of the staff corps bear titles designating their life professions, and it appears as though the adoption by them of these which, throughout our whole naval history, have been borne by the line, could in no way increase their dignity or usefulness, but would merely place them in the position of masquerading under wrong colors. I have borne the title of lieutenant

too long to retain much fondness for it, but it is of value as showing my profession and the position which I have attained in it. I have never been able to comprehend why officers who take pride in their branch of the profession should not consider the title which identifies them with it as worthy of retention. I am, therefore, unable to agree with the suggestions of the essayist to do away with all titles in the service except those of the line.

It is unfortunate that the essayist did not divulge some of the "various good reasons now existing why the pay of officers of the different branches should not be equal." Nothing but the *best* of reasons could justify such inequality, and these are not even hinted at. A much fairer plan is that incorporated in some proposed legislation of paying all officers equally for the same length of service. Later in his paper, this is advocated by the writer, and I am glad to be able to agree with his conclusions better than with his premises.

In conclusion, I congratulate Mr. Bennett on the frank advocacy of his views before the Naval Institute, and trust that the discussion they are sure to provoke may prove advantageous to the service.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

CONSIDERATION ON THE BATTLESHIP IN ACTION.

By Wm. Laird Clowes, Associate Member.*

Most of the conditions which must regulate the conduct of the modern battleship in action have yet to be discovered. We have, at present, very little save speculation of a more or less academic kind to aid us in arriving at any definite conclusions as to what manner of thing the next fleet action will be. We do not even know exactly what effects can be brought about in real warfare by the numerous weapons which are now at our disposal, nor in what circumstances it will be wise to depend upon one of those weapons rather than another. We cannot foresee how the human element, which, after all, is the most important factor in the problem, will do its work in face of the comparatively mysterious forces which are waiting to be let loose against it. In short, it must be admitted that the world, at the beginning of the next great naval war, will watch for whatever may befall from much the same standpoint as is occupied by the audience when a conjurer first comes upon the stage. Almost anything may happen.

At present we have as our only guides, events, experiments, and accidents.

The events which are capable of suggesting lessons have been decided, for the most part, with extemporized materials, or with weapons already obsolete. We have the War of Secession, the campaign of Lissa, the river war in Paraguay, the bombardment of Alexandria, the operations of Admiral Courbet in China, the doings in the Black Sea and the Danube during the war between

*Prize Essayist, 1892.

Russia and Turkey, the troubles between Chile and Peru, the Chilean Rebellion, the Argentine Insurrection, and the attempted Revolution in Brazil; but the combined lessons of all these amount to very little indeed. For nearly thirty years we have not seen any large and properly disciplined naval force, furnished with all the newest resources of civilization, arrayed against a force of the same character. One may hope that one will never witness such a spectacle in the future; but the time has not yet come when any man can say with truth that there are signs of the near approach of the millennium.

Apart from the light that is shed for us by the meagre list of modern naval actions, we have a certain amount of light shed for us by experiments and by accidents. Here there is, in a diffused form, a good deal of light; for, although the glow proceeds from points each of which is small and insignificant, and although the area to be illuminated is immense, there is scarcely a direction whence at least one modest ray does not contribute its far-off aid towards rendering something at least of the general situation discoverable by him who will move carefully and feel his way. One may not be able to see everything, or anything, with distinctness, but one ought to be able to form a pretty shrewd idea concerning many things.

Nations have not begun to lay aside their inherited rivalries: the increase of armaments goes on everywhere unchecked; and it is still the part of prudence,—no matter how costly and distasteful the business may be,—to prepare, so far as is possible, for whatever may betide. I venture to think that, among our ordinary preparations, we rank too high the mere elaboration of machinery, and perfection of appliances, and we do not seriously enough regard the practical utilization of our materials. We build ships and guns; we worry about the latest powders; we pile intricate and delicate machinery into all our vessels; but, comparatively speaking, we make very few endeavors to be prepared, at a moment's notice, to meet all the developments and to answer all the questions which will assuredly arise whenever again two strong foes face one another upon the seas. There are here and there some who make efforts in this direction; but they seem to me to be the exceptions. The imaginative faculty is not one in the exercise of which the ordinary naval officer can be said to greatly

indulge himself. As a rule, he is not speculative. When he reasons he does not often go outside of the well-illuminated region of hard fact and unchallenged experience; and he appears to shrink from trying to strike a fresh light for himself in order to explore a little of the thick darkness ahead of him. Where facts and experiences of the needful sort are available, there are, of course, no better aids to the formation of sound conclusions. But here facts and experiences that are susceptible of direct application, and that are not merely of a broad and general character, are almost entirely wanting; and there is too much reason to fear that, in default of them, many who ought to be interested in the secrets of the naval future, are of opinion that speculation over such scanty materials as lie before them is rather a waste of time and energy.

The contrary view has much to recommend it. The man who is the most accustomed to reviewing and pondering over some of the myriad possibilities of the future, will certainly, other things being equal, be the best able to seize a situation and to come to a decision when instant action is suddenly called for. I do not suppose that his theories, worked out in an arm-chair, will be all right. In his study he may determine that, should a certain occasion crop up, he will pursue a certain course; and yet, when the occasion does crop up, he may find it desirable to move in a diametrically opposite direction. But he will not have wasted his time. The habit of thought will have widened his horizon and sharpened his eye; it will have left him less open to surprise; less liable to confusion. And I am persuaded, moreover, that in four cases out of five it will be found, when the time comes for action, to have landed him in a sound and sane groove of conduct, such as he might otherwise have easily missed.

It is with a hope of stimulating thought and provoking discussion, and not with any presumptuous intention of dogmatizing on the subject, that, instead of setting forth such views as I hold concerning the conduct of the Battleship in Action, I confine myself, in reply to the very gratifying invitation which has been addressed to me by the Board of Control, to the formulation of a number of questions on the subject. These questions seem to deserve the consideration not only of naval officers but also of naval administrations. They do not deal with the advantages or disadvantages

of various types of battleships, nor with the conduct in action of any battleships in particular. They claim attention equally in all countries which possess battleships.

1. Would it be prudent for any battleship to go into an engagement cleared for action merely as she is generally cleared for it during peace practice or manœuvres? Is any clearing for action that is not most complete and thorough of use as an instruction?

2. What should be done with a ship's boats upon clearing for action? Would it be prudent to hoist them all out, and to leave them, in tow of the steamboats, a few miles astern; or would it be prudent to expose them to the enemy's gun-fire in their positions on the booms and elsewhere? Preservation of the boats and reduction to the lowest possible quantity of the splinters flying about the deck must be considered on the one hand; on the other hand, the possible escape of one or more boats from the effects of projectiles, and the importance, if it can be secured, of having something ready for immediate lowering deserve attention.

3. What is likely to be the effect upon a ship's anchors of a successful attempt to use the ram? What the effect upon them of the ship's heavy forward guns if fired nearly ahead and with some depression? Is it or is it not important that you shall be in a condition to anchor at the close of an engagement?

4. Have you a thoroughly workable scheme whereby you can at once provide the proper substitute for any officer who may be killed or wounded, no matter in what part of the ship he may be stationed? Can you instantly made good the chain of authority throughout the vessel, no matter in what link it may be broken? Can you do this repeatedly? Can you do it if two or three links should break at once? Does your method of making good these breaks leave your chain dangerously weak in places, or only shorter as a whole?

5. To what extent do you propose to rely upon voice-tubes, electric wires for lighting, firing and signalling, helm indicators, engine-room telegraphs, etc., in action, and what provision have you for finding substitutes at an instant's notice for any or all of them?

6. How much more or less complicated and delicate gear have you in your ship upon which you would not think of depending if you were going into action? Do you use it at present? Is it wise to use it if you would not think of depending upon it?

7. What provision have you for making or answering signals in action? Have you any protected station for your signalmen?

8. What effect may be anticipated should a hostile projectile strike a fused shell in your racks, or a charged torpedo? How does a knowledge of what may happen in such an event influence your arrangements for keeping up a supply of ammunition to your more exposed guns, and for using your above-water torpedo tubes?

9. How would a suspicion that your bow tube might at the moment contain a live torpedo influence your decision, should an opportunity for ramming present itself?

10. Is there from your battery-deck an up-draught which would quickly free the battery from the gases of any explosion that might occur there? What consequences are to be apprehended there or elsewhere from the gaseous products of certain modern high explosives?

11. Can you get in your torpedo-net defenses sufficiently to enable you to manœuvre your ship, without the necessity of employing your men out-board in such a manner as to mask much of your own gun-fire as well as to expose the men to the fire of the enemy? If not, do you purpose, in wartime, to ever use your net defenses when you are liable to sudden attack?

12. Do you realize the continuous nature of the strain likely to be put upon executive officers by the conditions of modern warfare? Have you ready any scheme whereby this strain may be as much as possible equalized, and whereby both officers and men may husband their strength and nervous energy to the best advantage? For how long do you consider that a crew could stand the wear and tear of maintaining a position, say within fifty miles of a great port in which lay a hostile fleet and a large flotilla of torpedo-boats?

13. What will be the effect upon the occupants of a conning-tower even if it withstand the blow of a heavy projectile, (*a*) from the concussion, (*b*) from the displacement of the fittings? Should a commanding officer attempt to fight his ship from the conning-tower? If not, how should she be steered, and from what position can the captain enjoy the necessary view, while still maintaining communication of some sort with his officers?

14. To what extent, if any, can glass over dials, lamps, lan-

terns, etc., be depended upon in the event of a heavy explosion in its vicinity? To what extent, if any, can horn or talc be substituted for it? Is it advantageous or otherwise to have a brightly lighted battery on the occasion of a night action?

15. Will it in all cases be advantageous to use smokeless powder? What provision is there for the production of smoke should it be needed to serve as a screen to leeward?

16. What are the possible defenses of a ship under weigh against a torpedo that is approaching her? What is her safest position (*a*) if moving slowly, (*b*) if moving at speed, supposing that she cannot in time move out of the line of fire? What is the effect upon a torpedo of the explosion of a heavy charge under water within a short distance of it? What provision have you for the explosion of such a charge at short notice in or near the path of an advancing torpedo?

17. If your funnels be seriously damaged by projectiles, what speedily available provision can be made for the maintenance of a reasonable amount of draught?

18. If you decide to attempt to ram, at what speed will you steam, and how will your decision be affected by the direction in which the enemy is moving? Will you or will you not reduce speed upon making, or immediately before making contact?

19. Having sustained serious under-water injuries to her forward part, should a ship be steamed ahead or astern in order to run her into shallow water?

20. To what extent does the principle of the isolation of heavy guns, as carried out, for example, in the Royal Sovereign, Almirante Tamandare, etc., conflict with the control by the captain and by battery-officers of the ship's gun-fire? Can any disadvantage which might arise owing to this isolation be neutralized by the issue beforehand of general orders?

21. To what extent does the principle of closed water-tight compartments conflict with the communication of orders to various parts of the ship, supposing voice-tubes, wires, etc., to be dislocated or unserviceable? How is the difficulty to be provided against?

22. What provision is there for the prompt removal below of wounded men, without undue interference with the continuous transport to the deck of ammunition, and with the passage of messengers, etc.?

23. Of what use to an officer, especially one employed below, is a sword? Should any officer upon going to general quarters wear a sword? Would a couple of revolvers, supplemented perhaps by a short, heavy, pointed weapon shaped like the Roman sword, be more useful?

24. Are you prepared with any scheme whereby, even at risk to your ship, you can take on board, while under weigh, at least some coal, if such a proceeding be desirable? Do you habitually complete with coal in the shortest possible time, and is it desirable that when coaling you should always do this?

25. What are the advantages and the dangers attendant upon the use of the electric search-light against an enemy? Where should a search-light, if used, be projected from? What is its effect upon the sight of your own people? What its effect upon the sight of the enemy? To what extent can the projected ray be used as a screen? Are you prepared with any better method whereby an enemy's ships or works may at night be rendered visible to your gunners?

26. Is any range-finder as practically useful and quick, in daylight, as a rapid-firing gun? Would you use any other in action?

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EXTERRITORIALITY AND ASYLUM.

By Lieutenant J. H. Gibbons, U. S. N.

The instability of governments in the neighboring republics of Central and South America, coupled with the desire of the United States to extend its trade relations with those countries, has of late years placed the interpretation of certain principles of international law with the commanding officers of our public vessels in those waters. Such duty is always a delicate one. The Navy Regulations stipulate that, although due weight should always be given to the opinion and advice of our diplomatic and consular representatives in foreign countries, a commanding officer is solely and entirely responsible to his own immediate superior for all official acts in the administration of his command. Unfortunately, international law cannot be codified into set rules and regulations, and treaties do not always provide for cases that may arise. The Navy Regulations leave much to the judgment and discretion of the commander. A wave of public opinion may sustain one officer, who boldly steps beyond the strict letter of the law and appeals simply to patriotic feeling, while it overwhelms another who, while not a whit less patriotic, may be more prudent and conservative. In the light of this conflict between precept and practice it may prove interesting to examine the principles of (1) Exterritoriality and (2) Asylum, and their bearing upon recent cases that have arisen in Spanish-American countries.

Exterritoriality is thus defined by Woolsey:—"Certain classes of aliens are, by the comity of nations, exempted in a greater or less degree from the control of the law, in the land of their temporary

sojourn. They are conceived of as bringing their native laws with them out of their native territory, and the name given to the fiction of law,—for it seems there must be a fiction of law to explain a very simple fact,—is *exterritoriality*. This privilege is conceded especially . . . to the officers and crew of public armed vessels in foreign ports."

The privilege of exterritoriality, then, is conceded to public armed vessels, but being based upon international comity, this privilege is neither constant nor unlimited. The officers and crews are under their native laws when on board, but when on shore they are liable, if guilty of acts of aggression or hostility, to be opposed by force and arrested. A public armed vessel must, according to Ortolan, pay respect to the port and health laws.

Owing to this exemption of public armed vessels from the laws of the country in which they may be temporarily sojourning, there has been a tendency to claim that merchant vessels should, in some cases, enjoy the same immunity. International law, however, does not fully admit this. According to the English view, merchant vessels in her ports are entirely under local authority and jurisdiction. The Supreme Court of the United States has maintained the same principle. France, compromising between territorial sovereignty and exterritoriality, holds that "crimes committed on foreign merchant vessels, where none but the crew are concerned, are not cognizable by the French government, while offences committed on the shore and against others than the vessels' crews, do properly come before the French tribunals."

Closely connected with the question of exterritoriality is that of the right of vessels in a foreign port to grant asylum to fugitives from justice. In the case of criminals escaping to a foreign country, it is generally conceded that they ought to be given up. No nation is absolutely bound to do this, but the number of extradition treaties that have been negotiated among civilized nations shows that such an obligation is generally recognized. Political refugees, on the other hand, are not generally given up. This exemption rests on the broad principle of humanity, and the United States, more than any other nation, has always been active in upholding it. As the exterritorial character of public armed vessels is not denied, it naturally follows that such vessels may grant asylum. The U. S. Navy Regulations, following out the

above principle, prescribe (1) that vessels shall not be made a refuge for criminals, and (2) that political refugees shall be afforded shelter so far as the service upon which the ship is engaged will permit.

With reference to merchant vessels, the rule is different. They are entirely subject to the authorities of the port in which they are, and for that reason they cannot, of course, be made a refuge for criminals, but the status of political refugees is not so clear. The question of the time and place of taking political refugees on board of a United States merchant vessel is sometimes considered. When asylum has been granted in a port of the state to which the refugee belongs, the local authorities have the right to go on board to investigate the fact and to effect the extradition. Much depends upon the manner in which the arrest is conducted, and such a seizure often gives rise to international complications.

Having thus briefly stated the principles of positive and conventional international law that bear upon the question of exterritoriality and asylum, they may be illustrated by the history of four cases that, between 1885 and 1892, concerned the United States in its relations with the Spanish-American republics of Nicaragua, Guatemala, and Venezuela.

I. *The Gámez Case.*—In January, 1885, Don Jose Dolores Gámez, a Nicaraguan political refugee, having embarked at San José, Guatemala, for Punta Arenas, Costa Rica, on board of the Pacific Mail Company's steamship Honduras (a United States merchant vessel), efforts were made by the Nicaraguan authorities to arrest Gámez while the steamer was lying in one of their ports—San Juan del Sur. The captain of the Honduras refused to give up his passenger; refused to go on shore when requested by the commandante to do so, and finally, when requested not to sail for twenty-four hours, did, it was alleged, sail in two hours and without the usual permit from the commandante of the port. The United States minister gave it as his opinion that, under the circumstances, the Nicaraguan government had no right to arrest Gámez, but, in the correspondence that followed, our Secretary of State, Mr. Bayard, replying to the minister's request for more definite instructions in such cases, wrote as follows:

"It is clear that Mr. Gámez voluntarily entered the jurisdiction of a country whose laws he had violated. Under the circumstan-

ces, it was plainly the duty of the captain of the Honduras to deliver him up to the local authorities upon their request. It may safely be affirmed that when a merchant vessel of one country visits the port of another for the purposes of trade, it owes temporary allegiance and is amenable to the jurisdiction of that country, and is subject to the laws which govern the port it visits, so long as it remains, unless it is otherwise provided by treaty. Any exemption or immunity from local jurisdiction must be derived from the consent of that country. No such exemption is made in the treaty of commerce and navigation concluded between this country and Nicaragua on the 21st day of June, 1867."

Mr. Bayard lays down the plain proposition that the Honduras had no exterritorial character whatever; but a curious turn was given to this case when the captain of the Honduras was tried in the Nicaraguan courts for the crime of disrespect against the authority of the governor and intendant of San Juan del Sur. The judge decided that the delivery of Gámez to the Nicaraguan authorities could not properly be demanded of the captain under the circumstances, and that the charge of disrespect for the authorities was unfounded. This decision was based upon the following considerations, which are embodied in the decree :—

(1) That the resistance was not clearly shown to have been an open one.

(2) That to justify the delivery, the embarking of Gámez must be made in Nicaraguan waters.

(3) That political refugees on foreign merchant vessels are exempt from local jurisdiction.

(4) That the demand for Gámez's delivery, having been simply an oral one, was not sufficiently formal, and that in the request for the appearance of the captain before the Nicaraguan authorities, the object for which his presence was desired was not stated.

(5) That the sailing of the ship before the authorized time did not constitute a crime, but only furnished ground for a civil action, resulting from violation of contract.

There was no United States war-vessel present at the time of this incident, but it is interesting to speculate upon what would have been the result had there been such a vessel present. Suppose the naval commander, after consulting with the United States minister, —who, we have seen, gave it as his opinion that the Nicaraguan

government had no right to arrest Gámez—had decided to resist, by force, any attempt to take this passenger out of the Honduras. For this act and its consequences, he would have found himself in the equivocal position of being censured by his own government for exceeding his authority, while upheld by the nation whose territorial authority he had presumably violated.

II. *The Barrundia Case*:—On the 28th of August, 1890, General J. Martin Barrundia, was killed on board of the Pacific Mail Company's Steamer Acapulco in the harbor of San José, Guatemala, by local officers that were attempting to arrest him. Barrundia had been Secretary of War under President Barrios, and was charged with the crimes of murder and embezzlement as well as with rebellion and high treason. He fled to Mexico, and upon the breaking out of a war between Guatemala and San Salvador, headed an armed invasion of his native country. This expedition proving unsuccessful, he was compelled to re-cross the Mexican frontier and was afterwards disarmed and thrown into prison by the Mexican authorities. Having been subsequently released, he took passage from Acapulco, Mexico, in the Pacific Mail steamer Acapulco, his destination, according to his own statement, being New York, but it was claimed by the Guatemalan government that he intended to land in San Salvador. The steamer was to stop at two Guatemalan ports, Champerico and San José, on her way to Panama, and this fact was known to Barrundia when he embarked. Diplomatic negotiations were going on when the Acapulco arrived at Champerico, and the captain was permitted to proceed with his passenger to San José, where he was to place himself under the orders of the United States minister. Arriving in San José, the captain of the Acapulco was informed by the United States minister that, in his opinion, Guatemala had the right to arrest Barrundia. In attempting to make the arrest, the Guatemalan officials were fired upon by Barrundia, and in the *mêlée* he was killed.

Two United States war-vessels were lying in the roadstead of San José at the time. The senior officer present, being aware of the expected arrival of Barrundia, telegraphed the fact to our minister and suggested that as peace had been declared, the Guatemalan government be requested to permit his vessel to take Barrundia back to Acapulco, Guatemala's municipal rights over the mail steamer being acknowledged. To this communication our

minister replied: "Government declines offer to take Barrundia away in Thetis. Have advised Captain Pitts [of the Acapulco] to deliver him." The Acapulco was then in sight, and upon her arrival she was visited by the United States naval commander, who was told by Captain Pitts that he had put himself under the directions of the United States minister and purposed to abide by the latter's decision. Barrundia refused to see the naval commander, who then returned to his vessel. There was no interference by the United States war-vessels in the subsequent proceedings on board of the Acapulco.

The Navy Department did not uphold the conduct of the senior officer present. In reviewing the case, the Department established the following rules of conduct, which it held should have governed a commanding officer:—

(1) When the Acapulco was sighted off San José, the senior naval officer present should have proceeded at once to meet her outside, to warn the captain of the danger, and to offer the passenger asylum.

(2) In case circumstances prevented this being done, the senior naval officer present should have made a full investigation of the facts, when the Acapulco arrived in port, in order to ascertain the sufficiency of the charge and of the authority upon which the proposed removal of the passenger was based. He should have then prevented by his presence, with such assistance as he might find necessary, any proceedings on board the steamer calculated to endanger the safety of those on board. Finally, if upon examination it appeared that a seizure was to be attempted without proper warrant, or that the proceedings were merely in the nature of a pretext to secure the person of a political fugitive, the naval commander should have offered the passenger asylum on his own vessel.

This decision, it will be seen, reverses the one given by the Secretary of State in the Gámez case, so far as the former applies to merchant vessels within the jurisdiction of a foreign country. The Honduras was held, in the case of Gámez, to have no exterritorial character whatever; the Acapulco, in the case of Barrundia, was held to have such a character where any proceedings of the local authorities endangered the safety of those on board or where asylum was given to a political refugee.

III. *The Case of the Caracas*:—On the 18th of August, 1892, at Puerto Cabello, Venezuela, six passengers, bound from La Guayra, Venezuela, to Curaçao, a Dutch port, were taken out of the United States merchant steamer Caracas by General Urdaneta, a local military commander, who had an order for their arrest. These passengers had embarked at La Guayra with the full knowledge and consent of the recognized government of Venezuela and were not charged with any crime.

In the diplomatic correspondence that followed this incident, the minister of foreign affairs of Venezuela claimed that if his government considered the six passengers hostile, they had a legal right to take them out of the Caracas. In other words, foreign merchant vessels had no exterritorial character. The United States minister, following the precedent of the Barrundia case, argued that local jurisdiction in such cases was not absolute and unlimited. In reviewing the case, our Secretary of State, Mr. Foster, wrote as follows:—

"The relation of General Urdaneta to the party at the time in power at Caracas is not clearly understood, but it is believed to have been one of independent insurrection in the interest of the establishment of a so-called Western League of five Venezuelan States. Having gained temporary possession of Puerto Cabello, he seems to have made use of his arbitrary military power to invade a foreign mail steamer in transit, and to remove, by force, certain passengers who had lawfully embarked at another port of Venezuela, and against whom no lawful charge existed. It would be impossible for this government to acquiesce in the arbitrary and forcible violation of its flag by a merely military power, without due and regular warrant of law and in conformity with the ordinary course of justice, even though such force were exercised by the titular and responsible government of the country with which this government maintains friendly relations. The defiance of international rights and the hostile violation of the flag are more conspicuously indefensible, from every point of view, when committed by an irresponsible military chief, representing no recognized government and using brute force in furtherance of an insurrectionary movement. . . . Should the six passengers still be held by Urdaneta, the commander of the United States warships would be fully warranted in demanding their uncondi-

tional surrender, and, if refused, in backing up the demand by all necessary force."

This act of General Urdaneta was afterwards publicly disavowed by the Venezuelan government and the six passengers were allowed to continue their journey uninterrupted.

IV. *The Mejares Case*:—On the 6th of November, 1892, the American "Red D" steamship Philadelphia, plying between New York and Venezuelan ports, took on board at Curaçao, a Dutch port, Pedro Mejares, a Venezuelan citizen. The steamer touched at La Guayra, Venezuela, on her homeward voyage, and the local authorities there demanded Mejares on the ground that he was an enemy of the government. The Captain refused to surrender his passenger, whereupon the customs officers refused to clear the vessel or to return her register. The matter having been referred to the United States Minister at Caracas, he instructed our consul at La Guayra to clear the ship, provided that the only reason for detaining her was the captain's refusal to deliver up Mejares. The consul gave her clearance accordingly, and the next day she sailed.

The United States minister based his action upon the following considerations:—

(1) The civil war in Venezuela had ended a month before, and there had been no publication of martial law in any part of the republic. Consequently the belligerent rights of visitation and search did not exist.

(2) There was no contract, verbal or written, between the steamship company and the Venezuelan government, whereby the latter might claim the right of interference with passengers on board.

(3) There was no specific criminal charge against Mejares. It was orally stated that he was an enemy of the government. He was not a military man, nor in the service of any enemies of the government.

The Venezuelan authorities afterwards returned the ship's papers. It will be noticed that the United States minister does not touch upon the exterritorial character of merchant vessels when carrying political refugees in time of peace, but discusses belligerent rights alone. He also affirms the point made by the judges of the Nicaraguan court in the case of Gámez; *i. e.*, that a mere oral demand for the delivery of a passenger, even when made by a duly constituted authority, is not sufficient. The extradition

must be more formal. According to Requelmes (*Elementos de Derecho Publico Internacional*, edicion de Madrid, 1849), who is quoted by the Nicaraguan judge, "When it is known to the authorities that in a [foreign] merchant vessel asylum has been given to a criminal, they have the right to go on board to investigate the fact, and to effect the extradition, but having always present the consular agent or the commander of a ship of war in the port, of the same nation to which the merchant ship belongs." There must be, to quote again the language of Secretary Foster in the case of the Caracas, due and regular warrant of law and conformity with the ordinary course of justice.

An analysis of the opinions and decisions in the foregoing cases shows that neither the exterritoriality of public armed vessels in foreign waters nor the right of such vessels to grant asylum to political refugees, is brought into question. To what extent, then, may merchant vessels claim these rights, and how far would a naval commander be justified in upholding them?

The Navy Department, following the precedent of the Barrundia case, has embodied in the Regulations of 1893, Art. 287, page 68, this paragraph: "When a political refugee has embarked, in the territory of a third power, on board a merchant vessel of the United States as a passenger for purposes of innocent transit, and it appears upon the entry of such vessel into the territorial waters that his life is in danger, it is the duty of the captain of a ship of the Navy present to extend him an offer of asylum." This regulation implies (1) that the territorial authority over a foreign merchant vessel is not absolute and unlimited, and (2) that a merchant vessel cannot grant asylum. On the other hand, the naval commander must assure himself, before offering asylum, (1) that the refugee is not a common criminal, (2) that he embarked in the territory of a third power, (3) that he is a passenger for the purpose of innocent transit, and (4) that his life is in danger. The most natural way for a naval commander to satisfy himself on these points would be to consult the diplomatic or consular representatives of his government, who, from their residence in the country, ought to be better acquainted with the facts; but we have seen that diplomats, like doctors, sometimes disagree. Again, a case might arise in which prompt action would be necessary, and a conference with diplo-

matic representatives impossible. The various conditions, therefore, cannot always be anticipated, and the Navy Regulations leave the matter to "the sound judgment of responsible officers", who must perform their duties "with all possible care and forbearance."

Another precedent established by the Navy Department's decision in the Barrundia case is, that a naval commander in a foreign port is required to prevent by his presence, with such assistance as he may find necessary, any proceedings on board of a United States merchant vessel calculated to endanger the safety of those on board. This is a radical departure from the theory of the exclusive territorial authority of a government over foreign merchant vessels in its ports. The passengers whose safety is endangered need not be either citizens of the United States or political refugees. The flag protects "those on board." If the local authorities, in executing some legal warrant, should proceed to use force in carrying it out, and should endanger thereby the safety of those on board, force may be used by our naval commanders to prevent it.

"The employment of force against a foreign and friendly state, or against any one within the territory thereof is illegal," according to Article 285, U. S. Navy Regulations, which goes on to say: "The right of self-preservation, however, is a right that belongs to states as well as to individuals, and in the case of states it includes the protection of the state, its honor, and its possessions, and the lives and property of its citizens against arbitrary violence, actual or impending, whereby the state or its citizens may suffer irreparable injury."

In cases similar to those that occurred in Venezuela, when that country was rent by civil disturbances and unable to control the action of some of its agents, the doctrine of self-preservation, as thus set forth, would justify a naval commander in affording United States property, such as merchant vessels, protection from unwarranted interference. The commander-in-chief of the United States naval forces assembled in Venezuelan waters at the time stated this principle in the following words:—"It is simply my duty to protect the United States flag and United States interests from annoyances and exactions which are outside the strict and proper enforcement of belligerent rights." He might have gone still further and asserted, under the precedent of the Barrundia

case, that, even in time of peace, it was his duty to protect the United States flag and United States interests against the exactions of hitherto conceded territorial rights, especially in the case of political refugees seeking asylum under that flag.

In conclusion, it is well to bear in mind the strong influence of that great factor—public opinion—upon the conduct of the civil and military representatives of a state. A fancied insult to the American flag will arouse a feeling of indignation that brushes aside legal technicalities. This swift, but often imperfect judgment, may encourage a naval commander to take the chance of error, that he may win the plaudits of his fellow citizens. Was Commodore Ingraham right when, at Smyrna, he threatened to destroy the Austrian frigate that held Martin Koszta a prisoner? Was Captain Wilkes right when, on the high seas, he took Mason and Slidell out of the Trent? Congress gave the one a gold medal and the other a sword. The question of might brought these commanders lasting reward, while the question of right was still being discussed by academicians and publicists.

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THE SOLUTION FOR THE ELEMENTS OF THE CHRONOMETER.

By Lieutenant U. R. Harris, U. S. Navy.

The general equation of the chronometer is expressed as follows:

$$r_n = r + (\theta - \theta_n)^2 k + t_n z \ldots\ldots [1]$$

In which r_n = rate at an observed temperature.

r = " " θ at time of epoch.

θ = temperature of compensation, or point of fastest running.

θ_n = temperature observed.

k = " constant, a change in rate due to a variation of 1° from θ.

z = change due to time, in a unit of time.

t_n = number of units of time.

$+r$ indicates a gaining rate; $-r$, a losing rate.

Developing equation [1], and putting $x = r + \theta^2 k$ and $y = -2\theta k$, we have

$$r_n = x + \theta_n y + \theta_n^2 k + t_n z; \ldots\ldots [2]$$

$$x + \theta_n y + \theta_n^2 k + t_n z - r_n = 0. \ldots\ldots [3]$$

Equation [3] will be then the expression for each equation of observation from which the four unknown quantities may be solved.

During 1884, Bond chronometer 510 was under trial in the temperature room at the U. S. Naval Observatory, and passed No. 2 amongst 16 chronometers. The trial began January 16, which is

also taken as the time of epoch, and ended March 24. The rates are the means of a period of time and correspond to the mean temperature, and are considered to belong to the last day of the period.

The following is the record of trial:

1884		θ_n	t_n	r_n
Jan'y	16–23	45.1°	7 days	— 1.389 sec.
"	24–31	55.2	15 "	+ 0.047 "
Feb'y	1–8	69.9	23 "	+ 0.771 "
"	9–16	85.0	31 "	— 0.150 "
"	16–23	89.7	38 "	— 0.720 "
"	23–M'ch 1	84.9	45 "	— 0.237 "
March	2–9	70.1	53 "	+ 0.216 "
"	10–17	55.2	61 "	— 0.329 "
"	17–24	51.1	68 "	— 0.721 "

From which are derived the following equations of observations, to be solved by

METHOD I.

$$
\begin{aligned}
x + 45.1y + 2934.01k + 7z + 1.389 &= 0\\
x + 55.2y + 3047.04k + 15z - 0.047 &= 0\\
x + 69.9y + 4886.01k + 23z - 0.771 &= 0\\
x + 85.0y + 7225.00k + 31z + 0.150 &= 0\\
x + 89.7y + 8046.09k + 38z + 0.720 &= 0\\
x + 84.9y + 7208.01k + 45z + 0.237 &= 0\\
x + 70.1y + 4914.01k + 53z - 0.216 &= 0\\
x + 55.2y + 3047.04k + 61z + 0.329 &= 0\\
x + 51.1y + 2611.21k + 68z + 0.721 &= 0.
\end{aligned}
$$

Thence are formed the coefficients for the normal equations. The products and sums are found in Table I.

$$
\begin{aligned}
9.00x + 606.20y + 43018.42k + 341.00z + 2.512 &= 0\\
606.20x + 43018.42y + 3195383.42k + 23172.80z + 143.474 &= 0\\
43018.42x + 3195383.42y + 246440705.31k + 1650283.02z + 9323.880 &= 0\\
341.00x + 23172.80y + 1650283.02k + 16387.00z + 91.609 &= 0.
\end{aligned}
$$

The results are as follows:

Rate for t_0 (January 16, 1884) = + 0.805 sec. $\pm$ 0.031

" θ " = 69.96° $\pm$ 1.06°

" k " = — 0.00330 sec. $\pm$ 0.00006

" z " = — 0.00684 sec. $\pm$ 0.00055.

METHOD II.

By ignoring z the work may be somewhat shortened, thus solving for three unknown quantities. The products and sums for the coefficients of the normal equations are found in Table II., and the new normal equations become

$$\begin{aligned} 9.00x + 606.20y + 43018.42k + 2.512 &= 0 \\ 606.20x + 43018.42y + 3195383.42k + 143.474 &= 0 \\ 43018.42x + 3195383.42y + 246440705.31k + 9323.880 &= 0 \end{aligned}$$

with the following results. The epoch is for t_{38}, the middle time.

Rate for t_{38} (February 23, 1884) $= +0.498$ sec. ± 0.046
" θ " $= +69.97° \pm 1.46°$
" k " $= -0.00311$ sec. ± 0.00009.

By substituting these values in the equation $r = r_n - (\theta - \theta_n)^2 k$ we will obtain residuals containing z. Expressing them in terms of $t_n z$, counting from t_{38} as below, we have

	sec.	tz	v	vv	
$-31z =$	$+0.037$	$+0.241$	-0.204	0.042	$\epsilon = \sqrt{\frac{0.114}{150}} = \pm 0.028$
$-23z =$	$+0.227$	$+0.179$	$+0.048$	0.002	$\gamma =$ ± 0.019
$-15z =$	$+0.273$	$+0.116$	$+0.157$	0.025	$\epsilon_0 = \frac{0.028}{\sqrt{151}} = \pm 0.00228$
$-7z =$	$+0.055$	$+0.024$	$+0.031$	0.001	$\gamma_0 = \frac{0.019}{\sqrt{151}} = \pm 0.00155$
$+7z =$	-0.042	-0.024	$+0.018$	..	
$+15z =$	-0.282	-0.116	-0.166	0.028	
$+23z =$	-0.149	-0.179	$+0.030$	0.001	
$+30z =$	-0.112	-0.234	$+0.122$	0.015	
$151z =$	-1.177 sec.			0.114	

$z = -0.00779$ sec. ± 0.00155.

Should we substitute into equation [1], there will be the following:

		sec.	v	vv
for 45.1°	$r = -1.389 + 1.924 + 0.055$	$= +0.590$	0.203	0.0412
" 55.2	$= +0.047 + 0.678 + 0.117$	$= +0.842$	0.049	0.0024
" 69.9	$= +0.771 + 0.000 + 0.179$	$= +0.950$	0.157	0.0246
" 85.0	$= -0.150 + 0.703 + 0.242$	$= +0.795$	0.002	0.0000
" 89.7	$= -0.720 + 1.210 + 0.296$	$= +0.786$	0.007	0.0000
" 84.9	$= -0.237 + 0.693 + 0.351$	$= +0.807$	0.014	0.0002
" 70.1	$= +0.216 + 0.000 + 0.413$	$= +0.629$	0.164	0.0269
" 55.2	$= -0.329 + 0.678 + 0.475$	$= +0.824$	0.031	0.0010
" 51.1	$= -0.721 + 1.119 + 0.530$	$= +0.916$	0.123	0.0151
		$9)\overline{7.139}$		0.1114

$r = +0.793$ sec. ± 0.034 for t_0.

$$\epsilon = \sqrt{\frac{0.114}{5}} = \pm 0.149 \qquad \gamma = \pm 0.101$$

$$\epsilon_0 = \frac{0.149}{\sqrt{4}} = \pm 0.050 \qquad \gamma_0 = \frac{0.101}{\sqrt{9}} = \pm 0.034$$

t_0 corresponds to January 16th.

Method III.

By combining the corresponding pairs of temperatures and their rates, we may readily solve by algebra for r, θ and k, using equation [3].

55.2° + 0.047 sec.	69.9° + 0.771 sec.
55.2 — 0.329 "	70.1 + 0.216 "
$\theta_1 = 55.2°$ $r_1 = -0.141$ sec.	$\theta_2 = 70.0°$ $r_2 = +0.494$ sec.

85.0° — 0.150 sec.
84.9 — 0.237 "

$\theta_3 = 84.95°$ $r_3 = -0.194$ sec.

$$x + 55.20y + 3047.04k + 0.141 = 0$$
$$x + 70.00y + 4900.00k - 0.494 = 0$$
$$x + 84.95y + 7216.50k + 0.194 = 0$$
$$14.80y + 1852.96k - 0.635 = 0$$
$$14.95y + 2316.50k + 0.688 = 0$$
$$k = -0.00299 \text{ sec.}$$
$$y = +0.4172$$
$$\theta = 69.77°$$
$$x = -14.059 \text{ sec.}$$
$$r = +0.496 \text{ sec. for } t_{31},\ t_0 \text{ being Jan'y 23,}$$
$$t_{31} \text{ " Feb'y 23.}$$

In the general equation $r = r_n - (\theta - \theta_n)^2 k$, we will find for

55.2°	$r = +0.047 + 0.637 =$	$+0.684$ sec.
69.9	$= +0.771 + 0.000 =$	$+0.771$ "
85.0	$= -0.150 + 0.691 =$	$+0.541$ "
84.9	$= -0.237 + 0.682 =$	$+0.445$ "
70.1	$= +0.216 + 0.000 =$	$+0.216$ "
55.2	$= -0.329 + 0.637 =$	$+0.308$ "
		6)2.965 sec.

$r = +0.494$ sec. for t_{31}.

The influence of time is plainly indicated. The short time, 54 days, is scarcely sufficient to give a reliable value to this small

quantity. Solving the expression $r + t_n z = r_n - (\theta - \theta_n)^2 k$, we find $z = -0.01099$ sec. and $r = +0.835$ sec. for Jan'y 23. Substituting into equation [1] we have for

55.2°	$r = +0.684 + 0.088$	$= +0.772$ sec.
69.9	$= +0.771 + 0.176$	$= +0.947$ "
85.0	$= +0.541 + 0.264$	$= +0.805$ "
84.9	$= +0.445 + 0.418$	$= +0.863$ "
70.1	$= +0.216 + 0.506$	$= +0.722$ "
55.2	$= +0.308 + 0.593$	$= +0.901$ "
		6)5.010 sec.
		$r = +0.835$ sec. for t_0.

The following table will give the results of the different methods.

METHOD I.

$r_{t_0} = +0.805$ sec. ± 0.031
Jan'y 16, 1884,
$\theta = 69.96° \pm 1.06°$
$k = -0.00330$ sec. ± 0.00006
$z = -0.00684$ sec. ± 0.00055

METHOD II.

$r_{t38} = +0.498$ sec. ± 0.046
Feb'y 23, 1884,
$\theta = 69.97° \pm 1.46°$
$k = -0.00311$ sec. ± 0.00009

From the residuals
$r_{t_0} = +0.793$ sec. ± 0034
Jan'y 16, 1884,
$z = 0.00779$ sec. ± 0.00155

METHOD III.

$r_{t31} = +0.496$ sec.
Feb'y 23, 1884,
$\theta = 69.77°$
$k = -0.00299$ sec.

From the residuals
$r_{t_0} = +0.835$ sec.
Jan'y 23, 1884,
$z = -0.01099$ sec.

From App. III., Report of Naval Observatory. Washington, 1883.

$\theta = 69.8°$
$k = -0.00297$ sec.

During 1886, Bond 282 was under comparison, in natural temperatures, at the Mare Island Observatory, giving 36 equations of observation for periods of ten days each, t_0 corresponding to Dec. 31, 1885. The value of z being for the uniform period of ten days. The temperatures are readings of a maximum and

minimum thermometer. The rates are the mean of a ten day period and are assumed to correspond to the middle of the period. The original products and the additions for the normal equations may be kept to date as the observation are made. Crelle's tables will be found of great assistance to reduce the amount of labor. When it is considered that at one trial there are a number of chronometers under comparison it will be seen that it is possible to have common coefficients, with only different rates, to compute. With this arrangement and solution the complete running of the chronometer is readily solved for.

Tables III. show the solution of Bond 282.

Using seven places of logarithms, it is convenient to let $k' = 300k$, and to further reduce the size of the coefficients, divide by 10.

$$3.600x + 227.313y + 48.3133k' + 64.800z + 5.765 = 0$$
$$227.333x + 14494.001y + 3108.363k' + 4174.045z + 344.639 = 0$$
$$48.3133x + 3108.363y + 672.2879k' + 902.704z + 69.394 = 0$$
$$64.800x + 4174.045y + 902.704k' + 1554.900z + 90.334 = 0$$

The results are for

rate l_0 Dec. 31, 1885 $= -0.247$ sec. ± 0.011
" θ " $= 82.51° \pm 0.09$
" k " $= -0.00340$ sec. ± 0.00004
" z " $= +0.00028$ sec. ± 0.00002, for one day.

z might have been ignored, as before in the case of Bond 510, Method II., and solved for from the residuals.

For chronometer 282 Bond, Table III., there is a column for XII. mark, in which the cardinal magnetic point is entered as toward which the XII. hour mark of the chronometer face has been placed for the corresponding period. This is to detect any irregularity in rate due to polarity. This was discovered in one chronometer and was shown in a remarkable degree, sufficient to render that time-piece of no use for purpose of navigation.

It is believed that the astronomer upon expeditions carrying meridian distances, and having a number of chronometers in a proper room for them, can arrange to preserve small ranges of daily variation of temperatures, and so divide the periods of times as to conveniently express in the general equation of the

chronometer the equivalents to the rate, and compute the elements for discussion and result. It is, also, yet to be shown that rapid changes of temperature, necessary for trial tests, give results for the elements free from errors peculiar to the method, whereas the elements derived from natural temperatures taken at the time in which they are used seem to promise well. It is for the actual performance at the time of use.

Of course, it is absolutely necessary to preserve every precaution to obtain small ranges of temperatures, sufficient range of the mean temperatures throughout the time, accurate comparisons for rate, and, above all, good observations for time.

The method of comparison of the chronometers at the Mare Island Observatory gave special value to the rates. The ticks of the standard clock were thrown into the chronograph, then by taking the chronograph key in the hand and marking upon the chronograph the instant of the 55th, 60th and 5th seconds, there were recorded three comparisons with the standard clock; the mean corresponding to the even minute of the chronometer.

It is not necessary to read the temperature nearer than the nearest estimated quarter of a degree, but it is very important to preserve uniform temperature throughout the twenty-four hours. The mean should be also the average.

Trial test in the hot and cold room are necessary for the purchase of chronometers. The results will be useful till later determinations in natural temperatures may be had.

The coefficient of time is not usually considered in the computations of chronometers, but it sometimes has a very appreciable value, this can only be measured by a somewhat long interval of time.

The rates need only be recorded to the hundredths for the period of time.

A range of 18 to 20 degrees of θ_n will give good results.

In the case of Bond 282, it is not necessary to solve all 36 equations. Sufficient might have been selected to represent the best determined rates and temperatures, the extreme variation of temperatures for the periods, and the beginning and the end of the time under trial to obtain the influence of time.

This would probably be the method on board a ship so as to accept the best determined data for the solution, which would probably be at those times in port where rates are obtained.

Rejecting the poorer data, observing to keep the value of t from the epoch adopted, weights may be given the equations.

In order to determine an order of merit amongst several chronometers under comparison and trial for issue or purchase, it is convenient to assign certain arbitrary values to make up a multiple to exhibit the most essential qualities.

The solution and discussion by the method of least squares seem to suggest the following method in selecting chronometers for sea service. During a general cruise of three years it is probable that the temperatures of the chronometer box would fall between 49° and 89°. For this reason 69° is selected as the most desirable point of fastest running.

For the first part of the multiple the difference between the extreme changes of rate due to temperature within the limits of 49° and 89° is taken. It is the object to have this as small as possible.

The closeness of running to the rate curve is to be considered. This is measured by taking the square of one hundred times the probable error of the rate, and it constitutes the second part of the multiple.

It is convenient to have as little acceleration or retardation as possible. This is the third part of the multiple and is taken as one thousand times the amount of the daily acceleration or retardation, which corresponds nearly to a period of a cruise of three years.

The sum of the three parts makes up the multiple; the smaller the numerical value, the better is the chronometer. For particular purposes, as for work within the arctic regions or the tropics, especial values may be given the three parts.

We then find for the two chronometers the following:

	Bond 510.	Bond 282.
1st part	1.455	4.063
2d "	9.610	1.210
3d "	6.840	0.280
Multiple	17.905	5.553

In order to compare fairly these two chronometers, the multiples should be weighted, owing to the difference in the method of their trials. In the one instance the trial in the hot and cold room was rather short for a good determination of acceleration, and the great changes in temperature must necessarily influence the performance of the chronometer.

TABLE I.

To form the Coefficients of the Normal Equations.

Bond chronometer 510. *Four unknown quantities.*

a	*b*	*c*	*d*	*s*	*n*
1	45.1	2034.01	7	2087.11	+ 1.389
1	55.2	3047.04	15	3118.24	— 0.047
1	69.9	4886.01	23	4979.91	— 0.771
1	85.0	7225.00	31	7342.00	+ 0.150
1	89.7	8046.09	38	8174.79	+ 0.720
1	84.9	7208.01	45	7338.91	+ 0.237
1	70.1	4914.01	53	5038.11	— 0.216
1	55.2	3047.04	61	3164.24	+ 0.329
1	51.1	2611.21	68	2731.31	+ 0.721
[*aa*]	[*ab*]	[*ac*]	[*ad*]	[*as*]	[*an*]
1	45.1	2034.01	7	2087.11	+ 1.389
1	55.2	3047.04	15	3118.24	— 0.047
1	69.9	4886.01	23	4979.91	— 0.771
1	85.0	7225.00	31	7342.00	+ 0.150
1	89.7	8046.09	38	8174.79	+ 0.720
1	84.9	7208.01	45	7338.91	+ 0.237
1	70.1	4914.01	53	5038.11	— 0.216
1	55.2	3047.04	61	3164.24	+ 0.329
1	51.1	2611.21	68	2731.31	+ 0.721
9.00	606.20	43018.42	341	43974.62	+ 2.512
				43974.62	

[*bb*]	[*bc*]	[*bd*]	[*bs*]	[*bn*]
2034.01	91733.85	315.70	94128.66	+ 62.644
3047.04	168196.61	828.00	172126.85	— 2.594
4886.01	341532.10	1607.70	348095.71	— 53.893
7225.00	614125.00	2635.00	624070.00	+ 12.750
8046.09	721734.27	3408.60	733278.66	+ 64.584
7208.01	611960.05	3820.50	623073.46	+ 20.121
4914.01	344472.10	3715.30	353171.51	— 15.142
3047.04	168196.01	3367.20	174666.05	+ 18.161
2611.21	133432.83	3474.80	139569.94	+ 36.843
43018.42	3195383.42	23172.80	3262180.84	+ 143.474
			3262180.84	

TABLE I.—*Continued.*

TO FORM THE COEFFICIENTS OF THE NORMAL EQUATIONS.

Bond chronometer 510. *Four unknown quantities.*

[*cc*]	[*cd*]	[*cs*]	[*cn*]
4137196.68	14238.07	4245202.61	+ 2825.240
9284452.76	45705.60	9501402.01	— 143.211
23873093.72	112378.23	24331890.06	— 3767.114
52200625.00	223975.00	53045950.00	+ 1083.750
64739564.29	305751.42	65775096.07	+ 5793.185
51955408.16	324360.45	52898936.67	+ 1708.298
24147494.28	260442.53	24757322.92	— 1061.426
9284452.76	185869.44	9641565.85	+ 1002.476
6818417.66	177562.28	7132023.98	+ 1882.682
246440705.31	1650283.02	251329390.17	+ 9323.880
		251329390.17	

[*dd*]	[*ds*]	[*dn*]	[*sn*]	[*nn*]
49.00	14609.77	+ 9.723	+ 2898.996	1.929
225.00	46773.60	— 0.705	— 146.557	0.002
529.00	114537.93	— 17.733	— 3839.511	0.595
961.00	227602.00	+ 4.650	+ 1101.300	0.023
1444.00	310642.02	+ 27.360	+ 5885.849	0.518
2025.00	330250.95	+ 10.665	+ 1739.321	0.056
2809.00	267019.83	— 11.448	— 1088.232	0.047
3721.00	193018.64	+ 20.069	+ 1041.035	0.108
4624.00	185729.08	+ 49 028	+ 1969.274	0.520
16387.00	1690183.82	+ 91.609	+ 9561.475	3.798
	1690183.82		+ 9561.475	

[Final computation, Dec., 1892, by U. R. H.]

TABLE II.

To form the Coefficient of the Normal Equations.

Bond chronometer 510. *Three unknown quantities.*

a	*b*	*c*	*s*	*n*
1	45.1	2034.01	2080.11	+ 1.389
1	55.2	3047.04	3103.24	— 0.047
1	69.9	4886.01	4956.91	— 0.771
1	85.0	7225.00	7311.00	+ 0.150
1	89.7	8046.09	8136.79	+ 0.720
1	84.9	7208.01	7293.91	+ 0.237
1	70.1	4914.01	4985.11	— 0.216
1	55.2	3047.04	3103.24	+ 0.329
1	51.1	2611.21	2663.31	+ 0.721
[*aa*]	[*ab*]	[*ac*]	[*as*]	[*an*]
1	45.1	2034.01	2080.11	+ 1.389
1	55.2	3047.04	3103.24	— 0.047
1	69.9	4886.01	4956.91	— 0.771
1	85.0	7225.00	7311.00	+ 0.150
1	89.7	8046.09	8136.79	+ 0.720
1	84.9	7208.01	7293.91	+ 0.237
1	70.1	4914.01	4985.11	— 0.216
1	55.2	3047.04	3103.24	+ 0.329
1	51.1	2611.21	2663.31	+ 0.721
9	606.20	43018.42	43633.62	+ 2.512
			43633.62	

[*bb*]	[*bc*]	[*bs*]	[*bn*]
2034.01	91733.85	93812.96	+ 62.644
3047.04	168196.61	171298.85	— 2.594
4886.01	341532.10	346488.01	— 53.893
7225.00	614125.00	621435.00	+ 12.750
8046.09	721734.27	729870.06	+ 64.584
7208.01	611960.05	619252.96	+ 20.121
4914.01	344472.10	349456.21	— 15.142
3047.04	168196.61	171298.85	+ 18.161
2611.21	133432.83	136095.14	+ 36.843
43018.42	3195383.42	3239008.04	+ 143.474
		3239008.04	

TABLE II.—*Continued.*

TO FORM THE COEFFICIENTS OF THE NORMAL EQUATIONS.

Bond chronometer 510. *Three unknown quantities.*

[*cc*]	[*cs*]	[*cn*]
4137196.68	4230964.54	+ 2825.240
9284452.76	9455696.41	— 143.211
23873093.72	24219511.83	— 3767.114
52200625.00	52821975.00	+ 1083.750
64739564.29	65469344.65	+ 5793.185
51955408.16	52574576.22	+ 1708.298
24147494.28	24496880.39	— 1061.426
9284452.76	9455696.41	+ 1002.476
6818417.66	6954461.70	+ 1882.682
246440705.31	249679107.15	+ 9323.880
	249679107.15	

[*sn*]	[*nn*]
+ 2898.996	1.929
— 146.557	0.002
— 3839.511	0.595
+ 1101.300	0.023
+ 5885.849	0.518
+ 1739.321	0.056
— 1088.232	0.047
+ 1041.035	0.108
+ 1969.274	0.520
+ 9561.475	3.798
+ 9561.475	

[Final computation, Dec., 1892, by U. R. H.]

RECORD OF BOND 282, MARE ISLAND OBSERVATORY, CALIFORNIA.

	1886. 1885		1886	θ_n	t_n t = ten days.	r_n = that corresponding to the middle of the ten-day period.
1	Dec.	31–	Jan'y 10	50.4	0.5	—3.75 sec.
2	Jan'y	11–	20	48.7	1.5	—4.10 "
3		21–	30	57.2	2.5	—2.26 "
4		31–	Feb'y 9	60.3	3.5	—1.62 "
5	Feb'y	10–	19	61.2	4.5	—1.62 "
6		20–	March 1	58.4	5.5	—2.16 "
7		2–	11	55.2	6.5	—2.78 "
8		12–	21	56.3	7.5	—2.65 "
9		22–	31	61.9	8.5	—1.62 "
10	April	1–	10	59.3	9.5	—2.15 "
11		11–	20	58.0	10.5	—2.39 "
12		21–	30	61.9	11.5	—1.75 "
13	May	1–	10	62.3	12.5	—1.70 "
14		11–	20	65.6	13.5	—1.18 "
15		21–	30	68.7	14.5	—0.94 "
16	May	31–	June 9	66.5	15.5	—1.19 "
17	June	10–	19	70.2	16.5	—0.77 "
18		20–	29	70.8	17.5	—0.63 "
19		30–	July 9	70.8	18.5	—0.66 "
20	July	10–	19	71.8	19 5	—0.54 "
21		20–	29	67.7	20.5	—1.04 "
22		30–	August 8	69.7	21.5	—0.70 "
23	August	9–	18	69.3	22.5	—0.73 "
24		19–	28	71.9	23.5	—0.43 "
25		29–	Sept. 7	70.8	24.5	—0.71 "
26	Sept.	8–	17	71.4	25.5	—0.62 "
27		18–	27	68.0	26.5	—0.84 "
28		28–	Oct. 7	67.1	27.5	—1.00 "
29	Oct.	8–	17	65.7	28.5	—1.17 "
30		18–	27	65.0	29.5	—1.11 "
31		28–	Nov. 6	61.2	30.5	—1.72 "
32	Nov.	7–	16	60.8	31.5	—1.77 "
33		17–	26	57.8	32.5	—2.24 "
34		27–	Dec. 6	57.4	33.5	—2.31 "
35	Dec.	17–	16	56.3	34.5	—2.46 "
36		17–	26	57.7	35.5	—2.34 "

TABLE III.

To form the Coefficients of the Normal Equations.

Bond chronometer 282. *Four unknown quantities.*

No. of Eq.	Date, 1886.	XII hr.	*a*	*b*	*c*	*d*	*s*	*n*
1	Jan'y 10	S.	1	50.4	2540.16	.5	2592.06	+ 3.75
2	20	W.	1	48.7	2371.69	1.5	2422.89	+ 4.10
3	30	N.	1	57.2	3271.84	2.5	3332.54	+ 2.26
4	Feb'y 9	E.	1	60.3	3636.09	3.5	3700.89	+ 1.62
5	19	S.	1	61.2	3745.44	4.5	3812.14	+ 1.62
6	March 1	W.	1	58.4	3410.56	5.5	3475.46	+ 2.16
7	11	N.	1	55.2	3047.04	6.5	3109.74	+ 2.78
8	21	E.	1	56.3	3169.69	7.5	3234.49	+ 2.65
9	31	S.	1	61.9	3831.61	8.5	3903.01	+ 1.62
10	April 10	W.	1	59.3	3516.49	9.5	3586.29	+ 2.15
11	20	N.	1	58.0	3364.00	10.5	3433.50	+ 2.39
12	30	E.	1	61.9	3831.61	11.5	3906.01	+ 1.75
13	May 10	S.	1	62.3	3881.29	12.5	3957.09	+ 1.70
14	20	W.	1	65.6	4303.36	13.5	4383.46	+ 1.18
15	30	N.	1	68.7	4719.69	14.5	4803.89	+ 0.94
16	June 9	E.	1	66.5	4422.25	15.5	4505.25	+ 1.19
17	19	S.	1	70.2	4928.04	16.5	5015.74	+ 0.77
18	29	W.	1	70.8	5012.64	17.5	5101.94	+ 0.63
19	July 9	N.	1	70.8	5012.64	18.5	5102.94	+ 0.66
20	19	E.	1	71.8	5155.24	19.5	5247.54	+ 0.54
21	29	S.	1	67.7	4583.29	20.5	4672.59	+ 1.04
22	August 8	W.	1	69.7	4858.09	21.5	4950.29	+ 0.70
23	18	N.	1	69.3	4802.49	22.5	4895.29	+ 0.73
24	28	E.	1	71.9	5169.61	23.5	5266.01	+ 0.43
25	Sept. 7	S.	1	70.8	5012.64	24.5	5108.94	+ 0.71
26	17	W.	1	71.4	5097.96	25.5	5195.86	+ 0.62
27	27	N.	1	68.0	4624.00	26.5	4719.50	+ 0.84
28	Oct. 7	E.	1	67.1	4502.41	27.5	4598.01	+ 1.00
29	17	S.	1	65.7	4316.49	28.5	4411.69	+ 1.17
30	27	W.	1	65.0	4225.00	29.5	4320.50	+ 1.11
31	Nov. 6	N.	1	61.2	3745.44	30.5	3838.14	+ 1.72
32	16	E.	1	60.8	3696.64	31.5	3789.94	+ 1.77
33	26	S.	1	57.8	3340.84	32.5	3432.14	+ 2.24
34	Dec. 6	W.	1	57.4	3294.76	33.5	3386.66	+ 2.31
35	16	N.	1	56.3	3169.69	34.5	3261.49	+ 2.46
36	26	E.	1	57.7	3329.29	35.5	3423.49	+ 2.34

TABLE III.—*Continued.*

TO FORM THE COEFFICIENTS OF THE NORMAL EQUATIONS.

Bond chronometer 282. *Four unknown quantities.*

No. of Eq.	Date, 1886.	XII hr.	[*aa*]	[*ab*]	[*ac*]	[*ad*]	[*as*]	[*an*]
1	Jan'y 10	S.	1	50.4	2540.16	.5	2592.06	+ 3.75
2	20	W.	1	48.7	2371.69	1.5	2422.89	+ 4.10
3	30	N.	1	57.2	3271.84	2.5	3332.54	+ 2.26
4	Feb'y 9	E.	1	60.3	3636.09	3.5	3700.89	+ 1.62
5	19	S.	1	61.2	3745.44	4.5	3812.14	+ 1.62
6	March 1	W.	1	58.4	3410.56	5.5	3475.46	+ 2.16
7	11	N.	1	55.2	3047.04	6.5	3109.74	+ 2.78
8	21	E.	1	56.3	3169.69	7.5	3234.49	+ 2.65
9	31	S.	1	61.9	3831.61	8.5	3903.09	+ 1.62
10	April 10	W.	1	59.3	3516.49	9.5	3586.29	+ 2.15
11	20	N.	1	58.0	3364.00	10.5	3433.50	+ 2.39
12	30	E.	1	61.9	3831.61	11.5	3906.01	+ 1.75
13	May 10	S.	1	62.3	3881.29	12.5	3957.09	+ 1.70
14	20	W.	1	65.6	4303.36	13.5	4383.46	+ 1.18
15	30	N.	1	68.7	4719.69	14.5	4803.89	+ 0.94
16	June 9	E.	1	66.5	4422.25	15.5	4505.25	+ 1.19
17	19	S.	1	70.2	4928.04	16.5	5015.74	+ 0.77
18	29	W.	1	70.8	5012.64	17.5	5101.94	+ 0.63
19	July 9	N.	1	70.8	5012.64	18.5	5102.94	+ 0.66
20	19	E.	1	71.8	5155.24	19.5	5247.54	+ 0.54
21	29	S.	1	67.7	4583.29	20.5	4672.59	+ 1.04
22	August 8	W.	1	69.7	4858.09	21.5	4950.29	+ 0.70
23	18	N.	1	69.3	4802.49	22.5	4895.29	+ 0.73
24	28	E.	1	71.9	5169.61	23.5	5266.01	+ 0.43
25	Sept. 7	S.	1	70.8	5012.64	24.5	5108.94	+ 0.71
26	17	W.	1	71.4	5097.96	25.5	5195.86	+ 0.62
27	27	N.	1	68.0	4624.00	26.6	4719.50	+ 0.84
28	Oct. 7	E.	1	67.1	4502.41	27.5	4598.01	+ 1.00
29	17	S.	1	65.7	4316.49	28.5	4411.69	+ 1.17
30	27	W.	1	65.0	4225.00	29.5	4320.50	+ 1.11
31	Nov. 6	N.	1	61.2	3745.44	30.5	3838.14	+ 1.72
32	16	E.	1	60.8	3696.64	31.4	3789.94	+ 1.77
33	26	S.	1	57.8	3340.84	32.5	3432.14	+ 2.24
34	Dec. 6	W.	1	57.4	3294.76	33.5	3386.66	+ 2.31
35	16	N.	1	56.3	3169.69	34.5	3261.49	+ 2.46
36	26	E.	1	57.7	3329.29	35.5	3423.49	+ 2.34
			36.00	2273.30	146940.01	648.00	147897.31	+ 57.65
							147897.31	
	Numbers on this line are for $k' = 300k$				483.133		3440.433	

TABLE III.—*Continued.*

TO FORM THE COEFFICIENTS OF THE NORMAL EQUATIONS.

Bond chronometer 282. *Four unknown quantities.*

No. of Eq.	Date, 1886.	XII hr.	[*bb*]	[*bc*]	[*bd*]	[*bs*]	[*bn*]
1	Jan'y 10	S.	2540.16	128024.06	25.20	130639.82	189.00
2	20	W.	2371.69	115501.30	73.05	117994.74	199.67
3	30	N.	3271.84	187149.25	143.00	190621.29	129.27
4	Feb'y 9	E.	3636.09	219256.23	211.05	223163.67	97.69
5	19	S.	3745.44	229220.93	275.40	233302.97	99.14
6	March 1	W.	3410.56	199176.70	321.20	202966.86	126.14
7	11	N.	3047.04	168196.61	358.80	171657.65	153.46
8	21	E.	3169.69	178453.55	422.25	182101.79	149.19
9	31	S.	3831.61	237176.66	526.15	241596.32	100.28
10	April 10	W.	3516.49	208527.86	563.35	212667.00	127.49
11	20	N.	3364.00	195112.00	609.00	199143.00	138.62
12	30	E.	3831.61	237176.66	711.85	241782.02	108.32
13	May 10	S.	3881.29	241804.37	778.75	246526.71	105.91
14	20	W.	4303.36	282300.42	885.60	287554.98	77.41
15	30	N.	4719.69	324242.70	996.15	330027.24	64.58
16	June 9	E.	4422.25	294079.62	1030.75	299599.12	79.13
17	19	S.	4928.04	345948.41	1158.30	352104.95	54.05
18	29	W.	5012.64	354894.91	1239.00	361217.35	44.60
19	July 9	N.	5012.64	354894.91	1309.80	361288.15	46.73
20	19	E.	5155.24	370146.23	1400.10	376773.37	38.77
21	29	S.	4583.29	310288.73	1387.85	316327.57	70.41
22	August 8	W.	4858.09	338608.87	1498.55	345035.21	48.79
23	18	N.	4802.49	332812.56	1559.25	339243.60	50.59
24	28	E.	5169.61	371694.96	1689.65	378626.12	30.92
25	Sept. 7	S.	5012.64	354894.91	1734.60	361712.95	50.27
26	17	W.	5097.96	363994.34	1820.70	370984.40	44.27
27	27	N.	4624.00	314432.00	1802.00	320926.00	57.12
28	Oct. 7	E.	4502.41	302111.71	1845.25	308526.47	67.10
29	17	S.	4316.49	283593.39	1872.45	289848.03	76.87
30	27	W.	4225.00	274625.00	1917.50	280832.50	72.15
31	Nov. 6	N.	3745.44	229220.93	1866.60	234894.17	105.26
32	16	E.	3696.64	224755.71	1915.20	230428.35	107.62
33	26	S.	3340.84	193100.55	1878.50	198377.69	129.47
34	Dec. 6	W.	3294.76	189119.22	1922.90	194394.28	132.59
35	16	N.	3169.69	178453.55	1942.35	183621.89	138.50
36	26	E.	3329.29	192100.03	2048.35	197535.37	135.02
			144940.01	9325089.84	41740.45	9514043.60	3446.39
						9514043.60	
Numbers on this line are for $k' = 300k$				31083.633		220037.393	

TABLE III.—*Continued.*

TO FORM THE COEFFICIENTS OF THE NORMAL EQUATIONS.

Bond chronometer 282. *Four unknown quantities.*

No. of Eq.	Date, 1886.	XII hr.	[*cc*]	[*cd*]	[*cs*]	[*cn*]
1	Jan'y 10	S.	6452412.83	1270.08	6584247.13	9525.60
2	20	W.	5624913.46	3557.54	5746343.99	9723.93
3	30	N.	10704936.99	8179.60	10903537.68	7394.36
4	Feb'y 9	E.	13221150.49	12726.32	13456769.13	5890.47
5	19	S.	14028320.79	16854.48	14278141.64	6067.61
6	March 1	W.	11631919.51	18758.08	11853264.85	7366.81
7	11	N.	9284452.76	19805.76	9475502.17	8470.77
8	21	E.	10046934.70	23772.68	10252330.62	8399.68
9	31	S.	14681235.19	32568.68	14954812.14	6207.21
10	April 10	W.	12365701.92	33400.66	12611152.93	7560.45
11	20	N.	11316496.00	35322.00	11550294.00	8039.96
12	30	E.	14681235.19	44063.52	14966306.98	6705.32
13	May 10	S.	15064412.06	48516.12	15358613.84	6598.19
14	20	W.	18518907.29	58095.36	18863606.43	5077.96
15	30	N.	22275473.70	68435.50	22672871.59	4436.51
16	June 9	E.	19556295.06	68544.88	19923341.81	5262.48
17	19	S.	24285578.24	81312.66	24717767.35	3794.59
18	29	W.	25126559.77	87721.20	25574188.52	3157.96
19	July 9	N.	25126559.77	92733.84	25579201.16	3308.34
20	19	E.	26576499.46	100527.18	27052328.11	2783.83
21	29	S.	21006547.22	93957.44	21415376.68	4766.62
22	August 8	W.	23601038.45	104448.94	24048954.35	3400.66
23	18	N.	23063910.20	108056.02	23509581.27	3505.82
24	28	E.	26724867.55	121485.84	27223217.96	2222.93
25	Sept. 7	S.	25126559.77	122809.68	25609277.00	3558.97
26	17	W.	25989196.16	129997.98	26488286.44	3160.74
27	27	N.	21381376.00	122536.00	21822968.00	3884.16
28	Oct. 7	E.	20271695.81	123816.28	20702126.21	4502.41
29	17	S.	18632085.92	123019.96	19043015.76	5050.29
30	27	W.	17850625.00	124637.50	18254112.50	4689.75
31	Nov. 6	N.	14028320.79	114235.92	14375523.08	6442.16
32	16	E.	13665147.29	116444.16	14010043.80	6543.05
33	26	S.	11161211.91	108577.30	11466230.60	7483.48
34	Dec. 6	W.	10855443.46	110374.46	11158231.90	7610.90
35	16	N.	10046934.70	109354.30	10337912.24	7797.44
36	26	E.	11084171.90	118189.80	11397791.02	7790.54
			605059127.31	2708113.72	617237270.88	208181.95
					617237270.88	
Numbers on this line are for $k' = 300k$			6722.879	9027.046	47316.691	693.940

TABLE III.—*Continued.*

TO FORM THE COEFFICIENTS OF THE NORMAL EQUATIONS.

Bond chronometer 282. *Four unknown quantities.*

No. of Eq.	Date, 1886.	XII hr.	[*dd*]	[*ds*]	[*dn*]	[*sn*]	[*nn*]
1	Jan'y 10	S.	0.25	1296.03	1.88	9720.23	14.0625
2	20	W.	2.25	3634.34	6.15	9933.85	16.8100
3	30	N.	6.25	8331.35	5.65	7531.54	5.1076
4	Feb'y 9	E.	12.25	12953.12	5.64	5995.42	2.6244
5	19	S.	20.25	17154.63	7.29	6175.66	2.6244
6	March 1	W.	30.25	19115.03	11.88	7506.99	4.6656
7	11	N.	42.25	20213.31	11.57	8638.58	7.7284
8	21	E.	56.25	24258.68	19.88	8571.40	7.0225
9	31	S.	72.25	33175.58	13.77	6322.88	2.6244
10	April 10	W.	90.25	34069.76	20.42	7710.51	4.6225
11	20	N.	110.25	36051.75	25.10	8206.07	5.7121
12	30	E.	132.25	44919.12	20.12	6835.51	3.0625
13	May 10	S.	156.25	49463.62	21.25	6727.05	2.8900
14	20	W.	182.25	59176.71	15.93	5172.48	1.3924
15	30	N.	210.25	69656.40	13.63	4515.66	0.8836
16	June 9	E.	240.25	69831.38	18.44	5361.24	1.4161
17	19	S.	272.25	82759.71	12.70	3862.11	0.5929
18	29	W.	306.25	89283.95	11.02	3214.21	0.3969
19	July 9	N.	342.25	94404.39	12.21	3367.94	0.4356
20	19	E.	380.25	102327.03	10.53	2833.67	0.2916
21	29	S.	420.25	95706.04	21.32	4859.38	1.0816
22	August 8	W.	462.25	106431.24	15.05	3465.20	0.4900
23	18	N.	506.25	110144.02	16.42	3573.56	0.5329
24	28	E.	552.25	123751.24	10.10	2264.38	0.1849
25	Sept. 7	S.	600.25	125169.03	17.40	3628.35	0.5041
26	17	W.	650.25	132494.43	15.81	3221.44	0.3844
27	27	N.	702.25	125066.75	22.26	3964.38	0.7056
28	Oct. 7	E.	756.25	126445.28	27.50	4598.01	1.0000
29	17	S.	812.25	125733.16	33.34	5161.67	1.3689
30	27	W.	870.25	127454.75	32.74	4795.75	1.2321
31	Nov. 6	N.	930.25	117063.27	52.46	6601.60	2.9584
32	16	E.	992.25	119383.11	55.76	6708.20	3.1329
33	26	S.	1056.25	111544.55	72.80	7687.99	5.0176
34	Dec. 6	W.	1122.25	113453.11	77.38	7823.18	5.3361
35	16	N.	1190.25	112521.40	84.87	8023.27	6.0516
36	26	E.	1260.25	121533.90	83.07	8010.97	5.4746
			15549.00	2766051.17	903.34	212589.33	120.4217
				2766051.17		212589.33	
Numbers on this line are for $k' = 300k$				66964.493		5101.320	

SOLUTION OF TABLE III. FOR CHRONOMETER BOND 282.

$[aa]$	$[ab]$	$[ac]$	$[ad]$	$[as]$	$[an]$	*Checks.*	
+3.600	+227.330	+48.3133	+64.80	+344.0433	+5.765	$[bb_1]$ +138.74	
0.5563025	2.3566568	1.6840667	1.8115750	2.5366131	0.7607993	$[bc_1]$ +57.512	
	0.5563025	0.5563025	0.5563025	0.5563025	0.5563025	$[bd_1]$ +82.105	
	1.8003543	1.1277642	1.2552725	1.9803106	0.2044968	+278.357	
						$[bs_1]$ +278.36	
	$[bb]$	$[bc]$	$[bd]$	$[bs]$	$[bn]$		
	+14494.00	+3108.363	+4174.045	+22003.74	+344.639	$[bc_1]$ +57.512	
	+14355.26	+3050.851	+4091.940	+21725.38	+364.0438	$[cc_1]$ +23.9060	
$[bb_1]$	+138.74	$[bc_1]$ +57.512	$[bd_1]$ +82.105	$[bs_1]$ +278.36	$[bn_1]$ −19.4048	$[cd_1]$ +33.0652	
	2.1422017	1.7597585	1.9143696	2.4446068	*n*1.2879091	+114.4832	
		2.1422017	2.1422017	2.1422017	2.1422017	$[cs_1]$ +114.484	
	Checks.	9.6175568	9.7721679	0.3024051	*n*9.1457074		
						$[cc_2]$ +0.0655	
$[bn_1]$	−19.4048	$[cc]$	$[cd]$	$[cs]$	$[cn]$	$[cd_2]$ −0.9698	
$[cn_1]$	−7.97437	+672.2879	+902.7046	+4731.669	+69.394	−0.9043	
$[dn_1]$	−13.436	+648.3819	+869.6394	+4617.185	+77.36837	$[cs_2]$ −0.9048	
	−40.81517	$[cc_1]$ +23.9060	$[cd_1]$ +33.0652	$[cs_1]$ +114.484	$[cn_1]$ −7.97437		
$[sn_1]$	−40.8151	+23.8405	+34.0350	+115.3888	−8.043885		
		$[cc_2]$ +0.0655	−0.9698	−0.9048	+0.069515		
$[cn_2]$	+0.069515	8.8162413	*n*9.9866822	$[cs_2]$ *n*9.9565526	$[cn_2]$ 8.8420785		
$[dn_2]$	−1.95243		8.8162413	8.8162413	8.8162413		
	−1.882915		*n*1.1704409	*n*1.1403113	0.0258372		
$[sn_2]$	−1.88243						
			$[dd]$	*ds*	$[dn]$	$[sn]$	$[nn]$
$[bd_2]$	+82.105		+1554.90	+6696.450	+90.334	+510.132	+120.4217
$[cd_2]$	+33.0652		+1166.40	+6192.779	+103.770	+550.9471	+92.3201
$[dd_1]$	+388.50		$[dd_1]$ +388.50	$[ds_1]$ +503.671	$[dn_1]$ −13.436	$[sn_1]$ −40.8151	$[nn_1]$ +28.1016
	+503.6702		+48.58894	+164.7308	−11.48357	38.93267	+27.1404
$[ds_1]$	+503.671		$[dd_2]$ +339.91106	$[ds_2]$ +338.9402	$[dn_2]$ −1.95243	$[sn_2]$ −1.88243	$[nn_2]$ +0.9612
			+14.35897	+13.3966	−1.02925	−0.96026	+0.7377
$[cd_2]$	−0.9698		$[dd_3]$ +325.55209	$[ds_3]$ +325.5436	$[dn_3]$ −0.92318	$[sn_3]$ −0.92217	$[nn_3]$ +0.2235
$[dd_2]$	+339.91106		2.5126205		*n*9.9652864		+0.0262
	+338.94126				2.5126205		$[nn_4]$ +0.1973
$[ds_2]$	+338.9402				log (−*s*) *n*7.4526659		
					$s' = +0.00283574$		

$s' = 10$ days. $s = 1$ day. Final computation, *Dec.* 1892, by U. R. H.

$\frac{[dn_3]}{[dd_3]}\,n$	7.4526659	$\frac{[cn_2]}{[cc_2]}$	0.0258372	$\frac{[bn_1]}{[bb_1]}$	n9.1457074	$\frac{[an]}{[aa]}$	0.2044968
		$\frac{[cd_2]}{[cc_2]}\,z'$	n8.6231068	$\frac{[bd_1]}{[bb_1]}\,z'$	7.2248338	$\frac{[ad]}{[aa]}\,z'$	8.7079384
				$\frac{[bc_1]}{[bb_1]}\,k'$	n9.6258639	$\frac{[ac]}{[aa]}\,k'$	n1.1360713
						$\frac{[ab]}{[aa]}\,y$	1.5491023
	−0.00283574		+1.061208		−0.1398645		+1.601389
			−0.041986		+0.0016782		+0.051043
					−0.4225362		−13.679535
							+35.408073
$-z'=$	−0.00283574	$-k'$	+1.019312	$-y=$	−0.5607225	$-x=$	+ 23.380970
$z'=$	+0.00283574	k'	−1.019312	$y=$	+0.5607225	$x=$	− 23.380970
	7.4526659		n0.0083071		9.7487480		n1.3688625
$[cd_1]$	1.5193711	$[bc]$	3.4925318	$[bc]$	3.4925318	$[bd]$	3.6205571
$[cd_1]^2$	3.0387422	$[bc]^2$	6.9850636	$[bd]$	3.6205571	$[bd]^2$	7.2411142
$[cc_1]$	1.3785069	$[bb]$	4.1611886		7.1130889	$[bb]$	4.1611886
	1.6602353		2.8238750	$[bb]$	4.1611886		3.0799256
	+45.73359		+666.6149		2.9519003		+1202.059
					+895.1592		
$[dd_1]$	388.50	$[cc]$	+672.2879	$[cd]$	+902.7046	$[dd]$	+1554.90
	45.73359		+666.6149		+895.1592		+1202.059
	342.76641		+5.6730		+7.5454	$[dd_1]_a$	+352.841
$[dd_2]_b$	2.5349982	$[cc_1]_a$	0.7538128	$[cd_1]_a$	0.8776823	$[aa]$	0.5563025
		$p_z'=[dd_3]$	2.5126205	$[bb_1]$	2.1422017	$[bb_1]$	2.1422017
$[cd_1]_a$	0.8776823	p_z'	325.5521	$[cc_2]$	8.8162413		2.6985042
$[cd_1]_a^2$	1.7553646				0.9584430	$[bb]$	4.1611886
$[cc_1]_a$	0.7538128	$[cc_3]$	8.8162413	$[cc_1]$	1.3785069		8.5373156
	1.0015518	$[dd_3]$	2.5126205		9.5799361	$[cc_2]$	8.8162413
	+10.03579		1.3288618	$[dd_3]$	2.5126205		7.3535569
		$[dd_2]$	2.5313653		2.0925566	$[cc_1]_a$	0.7538128
$[dd_1]_a$	+352.841		8.7974965	$[dd_2]_b$	2.5349982		6.5997441
	+10.03579	p_k'	+0.062733		9.5575584	$[dd_3]$	2.5126205
$[dd_2]_a$	+342.8052			p_y	+0.361043		9.1123646
	2.5350474					$[dd_2]_a$	2.5350474
							6.5773172
						p_x	+0.0003785

Multiply the weights, as solved for, by 10, on account of having divided the coefficients of the normal equations by that number. We have, then, for

$p_x = 0.003785$, $p_y = 3.61043$, $p_k' = 0.62733$, $p_z' = 3255.521$.

For an observation $\epsilon = \sqrt{\frac{0.1973}{36-4}} = \sqrt{0.006041} = \pm 0.0777$ mean error.

$\gamma =$ ± 0.0524 probable error.

For final results $\epsilon_0 = \frac{0.0777}{\sqrt{36}}$ ± 0.0129 mean error.

$\gamma_0 = \frac{0.0524}{\sqrt{36}}$ ± 0.0087 probable error.

$\epsilon_{oz'}$	± 0.00023	z' for ten days ± 0.00002 z for one day.
$\gamma_{oz'}$	± 0.00016	± 0.00002
$\epsilon_{ok'}$	± 0.01629	$k' = 300k$ ± 0.00005 k
$\gamma_{ok'}$	± 0.01124	± 0.00004
ϵ_{oy}	± 0.00678	y
γ_{oy}	± 0.00468	
ϵ_{ox}	± 0.20963	x
γ_{ox}	± 0.14463	

$y = -2\theta k$

$\theta = \frac{y}{-2\theta}$

$\theta = 82.515°$

$\log y$	9.7487480
" k	n7.5311858
	n2.2175622
" -2	n0.3010300
" θ	1.9165322

$x = r + \theta^2 k$

$r = x - \theta^2 k$

$r = -23.380970 + 23.13397$

$r = -0.247$ sec.

$\log \theta^2$	3.8330644
" k	n7.5311858
	n1.3642502
$\theta^2 k =$	-23.13397

$\log k'$	n0.0083071
" 300	2.4771213
" k	n7.5311858
$k =$	-0.0033977

Substituting into $r = r_n - (\theta - \theta_n)^2 k - t_n z$, the following are found:

						v	vv
50.4°,	$r =$	−3.75	+ 3.5043	− 0.0014	= − 0.247 sec.	0.000	0.000000
48.7		−4.10	+ 3.8851	− 0.0043	= − 0.219 "	.028	.000784
57.2		−2.26	+ 2.1774	− 0.0071	= − 0.090 "	.157	.024649
60.3		−1.62	+ 1.6768	− 0.0099	= + 0.047 "	.294	.086436
61.2		−1.62	+ 1.5437	− 0.0128	= − 0.089 "	.158	.024964
58.4		−2.16	+ 1.9759	− 0.0156	= − 0.200 "	.047	.002209
55.2		−2.78	+ 2.5350	− 0.0184	= − 0.263 "	.016	.000256
56.3		−2.65	+ 2.3350	− 0.0213	= − 0.336 "	.089	.007921
61.9		−1.62	+ 1.4440	− 0.0241	= − 0.200 "	.047	.002209
59.3		−2.15	+ 1.8311	− 0.0269	= − 0.346 "	.099	.009801
58.0		−2.39	+ 2.0420	− 0.0298	= − 0.378 "	.131	.017161
61.9		−1.75	+ 1.4440	− 0.0326	= − 0.339 "	.092	.008464
62.3		−1.70	+ 1.3885	− 0.0354	= − 0.347 "	.100	.010000
65.6		−1.18	+ 0.9721	− 0.0383	= − 0.246 "	.001	.000001
68.7		−0.94	+ 0.6485	− 0.0411	= − 0.333 "	.086	.007369
66.5		−1.19	+ 0.8714	− 0.0440	= − 0.363 "	.116	.013456
70.2		−0.77	+ 0.5153	− 0.0468	= − 0.302 "	.055	.003025
70.8		−0.63	+ 0.4663	− 0.0496	= − 0.213 "	.034	.001156
70.8		−0.66	+ 0.4663	− 0.0525	= − 0.246 "	.001	.000001
71.8		−0.54	+ 0.3901	− 0.0553	= − 0.205 "	.042	.001764
67.7		−1.04	+ 0.7457	− 0.0581	= − 0.352 "	.105	.011025
69.7		−0.70	+ 0.5580	− 0.0610	= − 0.203 "	.044	.001936
69.3		−0.73	+ 0.5934	− 0.0638	= − 0.200 "	.047	.002209
71.9		−0.43	+ 0.3828	− 0.0666	= − 0.114 "	.132	.017689
70.8		−0.71	+ 0.4663	− 0.0695	= − 0.313 "	.066	.004356
71.4		−0.62	+ 0.4198	− 0.0723	= − 0.272 "	.025	.000625
68.0		−0.84	+ 0.7158	− 0.0751	= − 0.199 "	.048	.002304
67.1		−1.00	+ 0.8074	− 0.0780	= − 0.271 "	.024	.000576
65.7		−1.17	+ 0.9607	− 0.0808	= − 0.290 "	.043	.001849
65.0		−1.11	+ 1.0423	− 0.0837	= − 0.151 "	.096	.009216
61.2		−1.72	+ 1.5437	− 0.0865	= − 0.263 "	.016	.000256
60.8		−1.77	+ 1.6022	− 0.0893	= − 0.257 "	.010	.000100
57.8		−2.24	+ 2.0754	− 0.0922	= − 0.257 "	.010	.000100
57.4		−2.31	+ 2.1431	− 0.0950	= − 0.262 "	.015	.000225
56.3		−2.46	+ 2.3350	− 0.0978	= − 0.223 "	.024	.000576
57.7		−2.34	+ 2.0923	− 0.1007	= − 0.348 "	.101	.010201
					36) − 8.890 "		.284896
					$r =$ − 0.247 sec.		

$\epsilon = \sqrt{\frac{0.284896}{36-4}} = \sqrt{0.008903} = \pm 0.094356$ mean error for an observation

$\gamma = \pm 0.063643$ probable error for an observation.

$\epsilon_0 = \frac{0.094356}{\sqrt{36}} = \pm 0.016$ mean error for result.

$\gamma_0 = \frac{0.063643}{\sqrt{36}} = \pm 0.011$ probable error for result.

Solving $r_r = r + (\theta - \theta_n)^2 k + t_n s$ for the value of θ we have

			v	vv
50.4°	$\theta - 50.4° = 32.11$	$\theta = 82.51°$	.02	.0004
48.7	$\theta - 48.7 = 33.71$	$\theta = 82.41$	.08	.0064
57.2	$\theta - 57.2 = 24.38$	$\theta = 81.58$	.91	.8281
60.3	$\theta - 60.3 = 20.18$	$\theta = 80.48$	2.01	4.0401
61.2	$\theta - 61.2 = 20.20$	$\theta = 81.40$	1.09	1.1881
58.4	$\theta - 58.4 = 23.83$	$\theta = 82.23$	.26	.0676
55.2	$\theta - 55.2 = 27.40$	$\theta = 82.60$	.11	.0121
56.3	$\theta - 56.3 = 26.71$	$\theta = 83.01$	.52	.2704
61.9	$\theta - 61.9 = 20.28$	$\theta = 82.18$	.31	.0961
59.3	$\theta - 59.3 = 23.83$	$\theta = 83.13$	.64	.4096
58.0	$\theta - 58.0 = 25.29$	$\theta = 83\ 29$	.80	.6400
61.9	$\theta - 61.9 = 21.26$	$\theta = 83.16$	.67	.4489
62.3	$\theta - 62.3 = 20.93$	$\theta = 83.23$	.74	.5476
65.6	$\theta - 65.6 = 16.91$	$\theta = 82.51$	.02	.0004
68.7	$\theta - 68.7 = 14.70$	$\theta = 83.40$	.91	.8281
66.5	$\theta - 66.5 = 17.04$	$\theta = 83.54$	1.05	1.1025
70.2	$\theta - 70.2 = 12.95$	$\theta = 83.15$	.66	.4356
70.8	$\theta - 70.8 = 11.29$	$\theta = 82.09$	.40	.1600
70.8	$\theta - 70.8 = 11.70$	$\theta = 82.50$	.01	.0001
71.8	$\theta - 71.8 = 10.12$	$\theta = 81.92$	.57	.3249
67.7	$\theta - 67.7 = 15.89$	$\theta = 83.53$	1.04	1.0816
69.7	$\theta - 69.7 = 12.30$	$\theta = 82.00$	.49	.2401
69.3	$\theta - 69.3 = 12.65$	$\theta = 81.95$	.64	.2916
71.9	$\theta - 71.9 = 8.58$	$\theta = 80.48$	2.01	4.0401
70.8	$\theta - 70.8 = 12.52$	$\theta = 83.32$	.83	.6889
71.4	$\theta - 71.4 = 11.43$	$\theta = 82.83$	.34	.1156

			v	vv
68.0°	$\theta - 68.0° = 14.02$	$\theta = 82.02°$	.47	.2309
67.1	$\theta - 67.1 = 15.64$	$\theta = 82.74$	.25	.0625
65.7	$\theta - 65.7 = 17.19$	$\theta = 82.89$	.40	.1600
65.0	$\theta - 65.0 = 16.70$	$\theta = 81.70$	.79	.6241
61.2	$\theta - 61.2 = 21.42$	$\theta = 82.62$	.13	.0169
60.8	$\theta - 60.8 = 21.78$	$\theta = 82.58$	.09	.0081
57.8	$\theta - 57.8 = 24.77$	$\theta = 82.57$	.08	.0064
57.4	$\theta - 57.4 = 25.20$	$\theta = 82.60$	.11	.0121
56.3	$\theta - 56.3 = 26.08$	$\theta = 82.38$	.11	.0121
57.7	$\theta - 57.7 = 25.41$	$\theta = 83.11$	.62	.3844
		$36)\,2969.64$		19.3824
		$82.49°$		

$$\epsilon = \sqrt{\frac{19.3824}{36-4}} = \sqrt{0.6057} = 0.7783 \text{ mean error of one observation.}$$

$$\gamma = \pm 0.5249 \text{ probable error of one observation.}$$

$$\epsilon_0 = \frac{0.7783}{\sqrt{36}} = \pm 0.13 \text{ mean error of result.}$$

$$\gamma_0 = \frac{0.5249}{\sqrt{36}} = \pm 0.09 \text{ probable error of result.}$$

RESULTS FOR CHRONOMETER BOND 282.

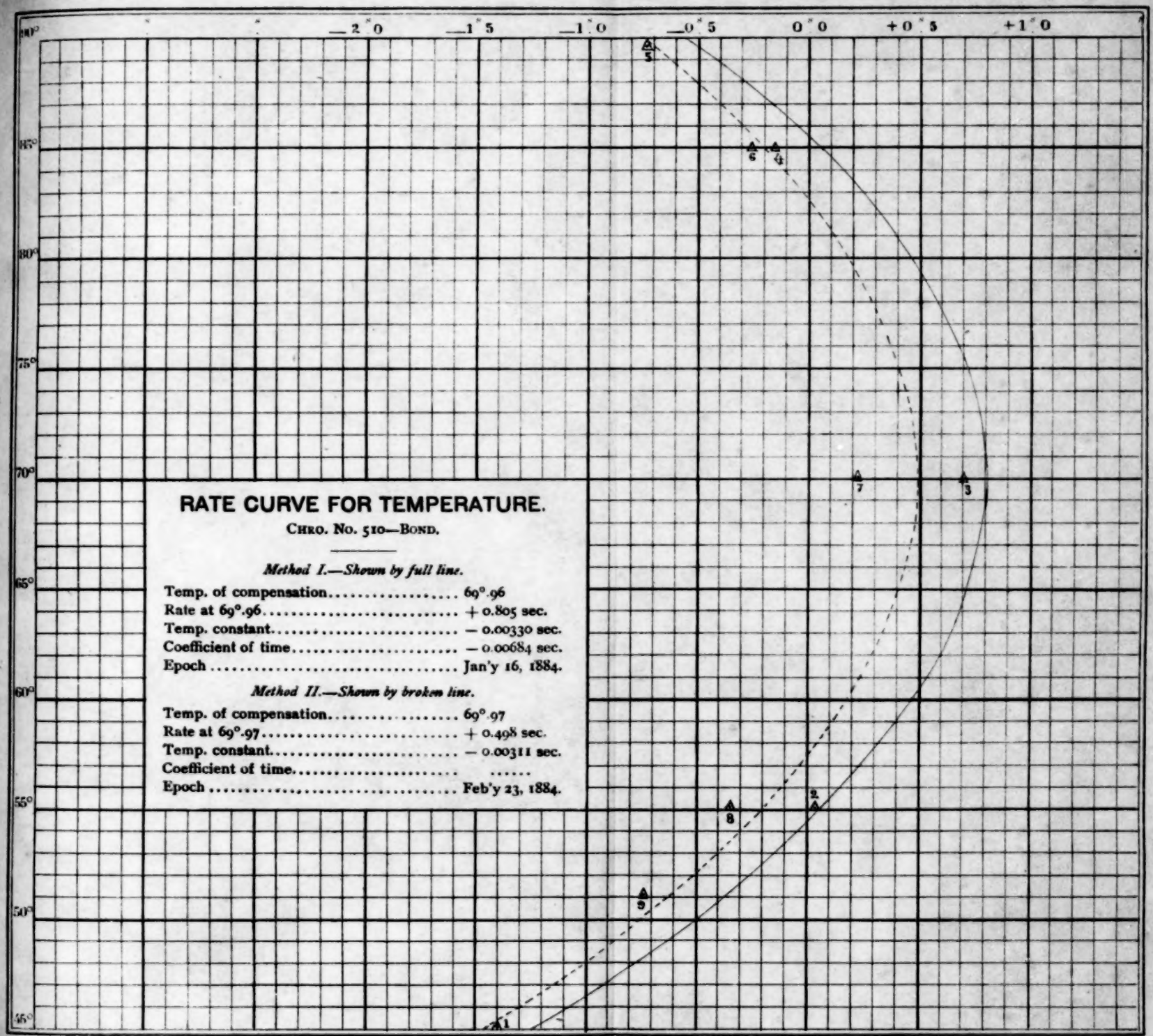
Rate for t_0 — 0.247 sec. $\pm$ 0.011, t_0 for Dec. 31, 1885.

θ 82.51° $\pm$ 0.09.

k —0.00340 sec. $\pm$ 0.0004.

s + 0.00028 sec. $\pm$ 0.00002 for one day.

ANNAPOLIS, MARYLAND, *July*, 1893.



RATE CURVE FOR TEMPERATURE.

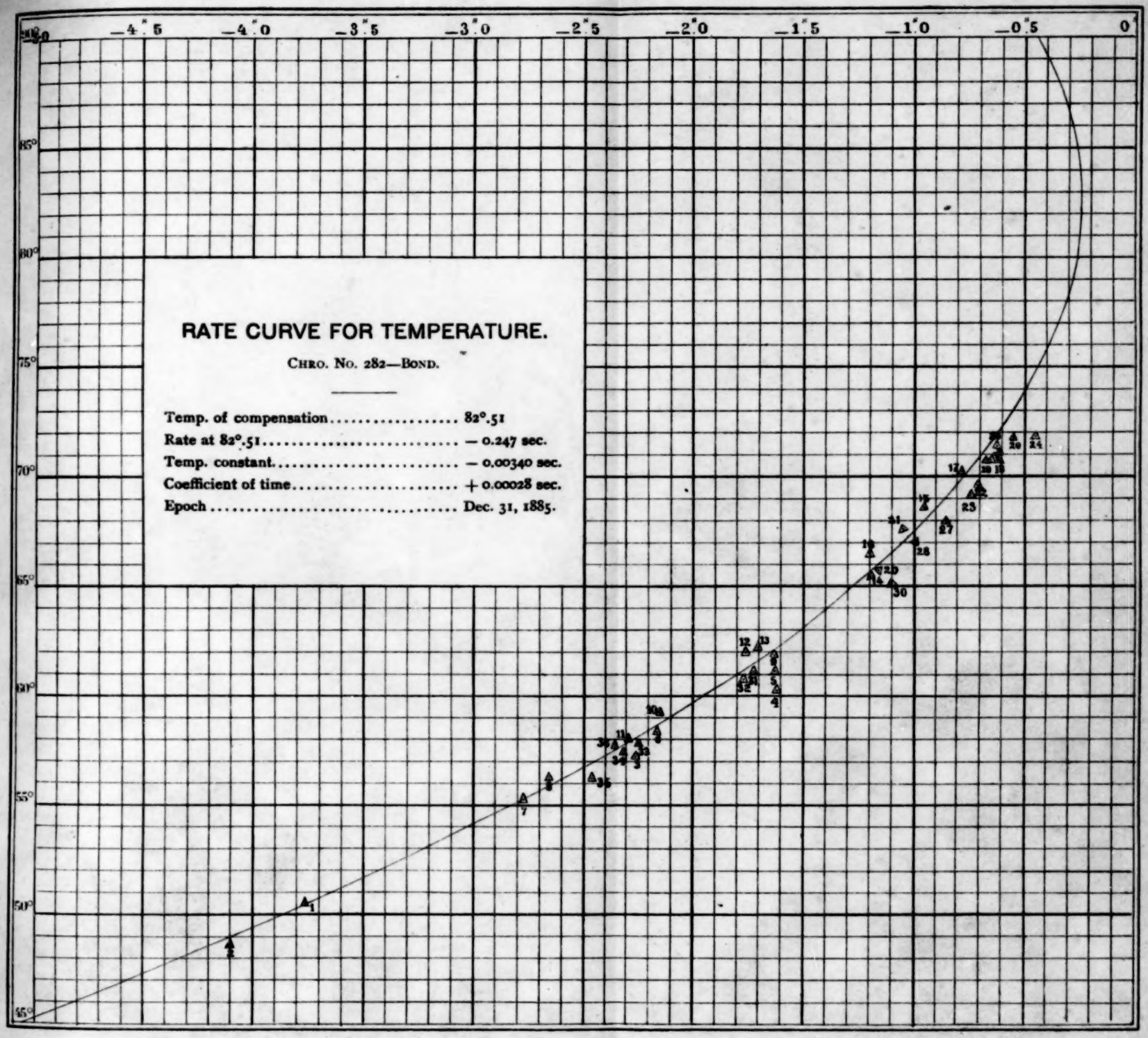
CHRO. NO. 510—BOND.

Method I.—Shown by full line.

Temp. of compensation	69°.96
Rate at 69°.96	+ 0.805 sec.
Temp. constant	— 0.00330 sec.
Coefficient of time	— 0.00684 sec.
Epoch	Jan'y 16, 1884.

Method II.—Shown by broken line.

Temp. of compensation	69°.97
Rate at 69°.97	+ 0.498 sec.
Temp. constant	— 0.00311 sec.
Coefficient of time	.....
Epoch	Feb'y 23, 1884.


−4″.5
−4″.0
−3″.5
−3″.0
−2″.5
−2″.0
−1″.5
−1″.0
−0″.5
0
85°
80°
75°
70°
65°
60°
55°
50°
45°
RATE CURVE FOR TEMPERATURE.
CHRO. NO. 282—BOND.
Temp. of compensation..... 82°.51
Rate at 82°.51..... − 0.247 sec.
Temp. constant..... − 0.00340 sec.
Coefficient of time..... + 0.00028 sec.
Epoch..... Dec. 31, 1885.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE CHILDREN OF NELSON.

[*By Permission from the New Review.*]

I have read lately a little unpretentious pamphlet of less than one hundred pages, written by a French naval officer who chooses to conceal his individuality under the signature of "J. Hunier" (or, as an Englishman might say, "Jack Topsail"). It is entitled "Du Navire de Combat;" it is published by MM. Berger-Levrault, of Paris; and it is a plain and simple study of the duties which must be performed in action by the modern warship and the modern officer and man engaged in her.

It is easy to perceive that this writer both understands and is not afraid of his subject. He approaches it without prejudice, prepared, if necessary, to fling away all the lessons which may have been handed down to him from days when neither ships nor weapons nor *personnel* were what they are now; he looks at it from a point of view that is wholly and severely practical; and he leaves the reader possessed of a deeply-rooted conviction that if many French naval officers have as much good sense, forethought and mastery of detail as this "Jack Topsail" gives evidence of enjoying, the French Navy may have before it a future even more brilliant than its warmest admirers venture to hope for it.

My friend "Jack Topsail" is a thoughtful and capable man, but not more thoughtful or more capable than many scores of officers who wear the same uniform. It is, indeed, characteristic of the French Navy of to-day that it thinks and that it looks forward. To be convinced that such is the case you need only spend half an hour in one of the chief booksellers' shops in Cherbourg,

Toulon or Brest. There you will find treatises, written for the most part by young officers, and warm from the press, on almost every branch of the naval science. Strategy, tactics, gunnery, torpedo-work, hydrography, electricity, signaling, construction and mechanics are all resolutely attacked, and the attack in nearly every case is developed with the assistance of ideas which are often as valuable as they are novel. There are everywhere signs of the healthiest and most promising mental activity. Everywhere there are indications that the questions most discussed in the French Navy are: How shall we secure the best material and *personnel*? and how shall we utilize them when the hour sounds for war? Association with French naval officers leads to the same conclusions. Not only do all, from the highest to the lowest, appear anxious to learn and to improve themselves in every sphere of knowledge that can possibly benefit them, but even among those numerous junior officers who are now too old to cherish any expectation of promotion to higher rank and command, and who, at five or six-and-forty, are still, alas! lieutenants, or, at three or four-and-thirty, are still *enseignes de vaisseau*, there is a singularly energetic spirit. They think and scheme; and their system, moreover, encourages them to think and scheme. The result is that the French Navy is essentially progressive, and therefore essentially modern. I am not blind to the fact that it still contains some anachronisms; but most of those that remain are retained, not by the Navy itself, but by the influence of the permanent administration in Paris, and even these are fast disappearing. I do not know exactly how the result has been secured. I can only bear admiring testimony to the truth that in the French Navy keenness, rivalry, invention, anxiety for progress, interest in other navies, real devotion to the service and a high standard of competency, are professional virtues so common that the absence of them in any officer seems to render him an Ishmaelite among his fellows.

Not less highly ought I to speak of the naval officers of Germany and of Austria. Among the ranks of these I count many intimate friends, not one of whom fails to surprise me occasionally with his wide professional knowledge or his thoughtful habit of mind. They are men who throw themselves, body and soul, into their work, and who do their work with a thoroughness that leaves nothing to be desired. A sophist may wriggle out of the verity

that knowledge is power, but all men who do not trifle with themselves are guided by it in every act of their lives. What is it that most commands confidence, and that chiefly fits a man to be a leader of men in these days of scientific complications? Courage alone will not do. Zulu indunas, courageous though they were, have failed to get their men to follow them against the barking machine-guns that spat bullets as inexplicably as the clouds spit lightning. Rank, or mere prestige alone, will not do. Only knowledge, with all that is comprised in it, can nowadays head any movement successfully. It may be scientific knowledge; it may be knowledge of human passions; it may even be nothing better than knowledge of human follies; but knowledge is necessary, and the wider the knowledge the deeper must be its influence. For this reason the value of French, German and Austrian naval officers as leaders of men is exceedingly high. In England, I am aware, it is the fashion to depreciate it. Over and over again have I heard British naval officers say: "Oh, it is easy to have too much science;" or, "Hang science! What I believe in is a cool head and plenty of dash;" or, "The next naval action will be won by the admiral who goes straightest and quickest for the enemy." These are the stock phrases of the present children of Nelson. But they are not cogent enough to convince any reasonable man, who knows the inevitable conditions of modern naval warfare, that a merely brave and dashing captain would be a better leader than a captain full of knowledge and forethought. In fencing, in fisticuffs, in *la savate*, in the bull-ring, dash wins occasional triumphs, but all the steady and permanent victories are won by knowledge; and the universal consciousness that this is the case creates in the minds of all those who are to be led, a craving that he who is to lead them shall be, if nothing else, a man who knows the whole of his business in all of its possible ramifications. The leader who most fully comes up to this ideal is the leader who, in the long run, will, provided other things be nearly equal, win.

Honored with an invitation to write an article on the British Navy as viewed from some standpoint a little less hackneyed than the familiar one of statistics, and of comparisons of ships with ships, and guns with guns, I venture—impelled thereto by my recent perusal of "Jack Topsail's" tract—to offer to English readers in general, and to British naval officers in particular, a few

observations, which I trust may not be deemed impertinent, upon the important subject of the policy of the Admiralty, so far as it is concerned with the training of your naval officers for the stern work of war.

It may, I fear, be difficult to touch this question without appearing to reflect upon the British naval officer as an individual, and therefore I at once and most formally disclaim the slightest intention of doing anything of the kind. I propose to look upon the naval officer as the creation of tradition and of system, and to examine him, not so much in order to discover whether or not he has done his part in the work of his professional education, as to find out whether those who have conducted his education have proceeded upon such lines as seem to be suitable and reasonable, regard being had to modern conditions. Upon his capacity depends the ultimate ability of the British Navy to do that work which it aspires to do in the world; and upon the ability of the British Navy to make good all its traditional pretentions depends to no small extent the future peace of Europe. Not merely Englishmen, consequently, but foreigners also, may fairly hold themselves to be personally interested in the matter. The failure of Great Britain to maintain her historical position upon the seas would speedily lead to radical rearrangement of a very much larger portion of the map of the world than has ever hitherto been disturbed upon any one occasion: and, quite apart from my sincere affection for England, I, in common with millions of others, have very solid reasons for wishing that we may never witness a transformation of the sort. The next despot of the seas may easily be a much less benevolent, and will certainly be a less firmly established, despot than Great Britain has been for the last three generations.

With regard to the British naval officer, it has always been the policy of the Admiralty "to catch him young." In the old days you often caught him when he was little more than a baby. Admiral Sir Charles Bullen went to sea when he had lived in the world but nine years and five months, and was many times in action before he was twelve. Admiral Sir Edward Hamilton went to sea when he was seven, and served as midshipman in action when he was eight; and his brother, Admiral Sir Charles Hamilton, went to sea at nine. I do not know of exactly what utility these

children can have been on shipboard, but I am quite prepared to admit that, under such rough and ready conditions as prevailed during the last century, a young officer could pick up all the professional education he needed, and even become a shining light in the service while deriving his instruction solely from the various people with whom he came into daily contact while afloat. It was not then necessary, and it certainly was not the rule, that an officer should be also a gentleman. Among officers there were, of course, some gentlemem. One may conclude from the correspondence of Lord Collingwood that he was one. But several of your greatest naval captains, including, I suspect, the very greatest of all, were nothing of the kind. That fact did not, however, impair their efficiency as leaders of the men whom they had to command. The men were brutally ignorant, and, indeed, nearly all illiterate. They were pressed or engaged from commission to commission; the majority of them had no permanent connection with the service; and those of them who became warrant officers, and remained so, associating themselves with the Navy as a career, differed only from the rough seamen from whom they had sprung in the fact that they had acquired a more or less competent knowledge of seamanship, navigation, gunnery, rigging, and other sailors' secrets. They were still, for the most part, illiterate; and though their superior officers possessed but a small amount of general education, they possessed enough of it to command the respect of people who had practically none. In a word, there was, speaking broadly, a much wider gap then than there is now between the least intelligent and the least cultivated of the commissioned officers and the most intelligent and most cultivated of the warrant officers and seamen.

At that period the necessities of the service did not demand that, so far as purely professional knowledge was concerned, a lieutenant or a captain should stand on a plane very much superior to that occupied by a good warrant officer, or, to be more exact, to that occupied by the *corpus* of executive warrant officers of a ship. It was sufficient if a captain had the combined lore of the master, the gunner, and the boatswain; and this was so fully recognized that, in practice, the naval education of "young gentlemen" was conducted almost exclusively by the warrant officers, who were their messmates and earliest counsellors. The age was not very scien-

tific, and it offered few surprises. Gunnery was in much the same condition in France or Spain as it was in England; the guns all over the world were similar, so also were the ships, the motive power, and the limitations generally; so that, when an officer had by instruction and experience, say, in one English frigate, made himself able to sail, manœuvre and fight that vessel, he needed no fresh instruction and very little fresh experience to enable him to sail, manœuvre, and fight any English frigate, any French frigate, or even any line-of-battle ship in existence.

How greatly have all things changed since then!

Education has progressed enormously. Illiteracy amongst naval seamen is absolutely unknown; and the mean intellectual standard on the lower deck to-day is certainly every bit as high as it was on the quarterdeck a hundred years ago, and probably very much higher. The advance, moreover, is not only in the direction of mere professional competency. The schoolmaster has been abroad, and he has not overlooked the general culture of the class whence the bluejacket is drawn. Boys are entered for the Navy between the ages of fifteen and sixteen and a half. Long ere he is fifteen every poor boy in the United Kingdom has been captured by the School Board and has been pushed through a certain number of "standards"; and I do not hesitate to say that, in general knowledge, many an English board-school boy of sixteen is the superior of the average English boy of gentle birth, but of only fourteen and a half years of age; and, in order to become an officer, a boy must pass for the Britannia when he is less than that. In practice, therefore, the educational gap which used to exist from the outset between young seamen and young officers has almost ceased to exist. It may be that the young officer of fourteen has sometimes a superficial smattering of French and Latin which the young seaman of sixteen lacks, but it may also be, and no doubt it frequently is the case, that the young seaman of sixteen has a better acquaintance with English history and literature, with geography, and even with mathematics, than the better-born child of fourteen.

And if general education has progressed enormously, naval science has progressed still more enormously and has correspondingly widened its sphere. There is now very little which a naval officer ought not to know. A hundred years ago seamanship, navigation, pilotage, and such elementary gunnery as there was, sufficed,

with experience, to place him on a par with the heads of his profession, either in England or elsewhere; to-day, in order to raise himself out of the ruck, he ought to know, in addition, much of chemistry, steam, law, electricity, pneumatics, hydraulics, hydrostatics, dynamics, metallurgy, and, above all, of current naval literature, home and foreign, together with at least a little of as many other subjects as possible. There is, too, more necessity than ever for him to be a man of culture, to be able to read and speak one or two languages beside his own, and to be familiar with modern history and international politics. And, since ships are nowadays often not only unlike all ships of other nationalities, but even unlike nearly all ships of the same nationality; and since almost every naval power has its own peculiar guns, small-arms, powders, explosives, torpedoes, mines, boilers, electrical systems, loading systems for guns, and a thousand other things, the officer who is fully equipped for his duties must have a very deep knowledge of foreign navies. I do not want to institute unnecessarily offensive comparisons, but I cannot, in order to bring out my meaning, refrain from calling attention to the superior qualifications of foreign officers in these respects.

I have before me a copy of a general examination paper on foreign navies. This was a few weeks ago put before a class of lieutenants in the service of a Continental power. There had been no special preparation, yet most of the answers were given correctly by every one of the officers, without any immediate assistance from books of reference, and many of the answers showed that the answerers were familiar with all the details of their subject. I take leave to doubt whether any British naval officer—even one fresh from the Intelligence Department of the Admiralty—could, in similar circumstances, produce proper and intelligent replies to so many as one-third of the questions. As some of my readers may be able to catch a naval officer and test him, and as the paper is not long, I translate it:—

1. Describe and criticise the peculiar position and arrangemen of the screws in the new French ironclad, Bouvines, and compare the arrangement with that adopted in an early British ironclad which still exists.

2. By means of a diagram show the arrangement, indicating also the calibres, of the guns on the upper deck of the Chilian ironclad Arturo Prat.

3. By means of a diagram show the armored protection of the British battleships of the Royal Sovereign type. If you were engaged with one of those vessels, upon what point or points would you direct (*a*) your heavy, and (*b*) your light and quick-firing gun fire, your guns being such as are carried in the Russian ironclad, Imperator Nikolai?

4. Describe the peculiarities of the breech-closing action of the service guns of the Russian Navy.

5. The complement of the Italian cruiser Fieramosca is as follows. (Details are given.) Assuming that you are in command in the Atlantic, of the Fieramosca, that you capture the French cruiser Forbin, that you can only utilize your own men, and that you wish to send the Forbin alone, manned by a prize crew, a distance of 770 miles, how would you, leaving all other considerations aside, form and assign duties to your prize crew, and how would you rearrange the work and routine of your remaining men?

6. Describe and compare the Belleville, Yarrow, Thornycroft, Normand and DuTemple boilers, and cite one vessel in which each type is now in use.

If this kind of knowledge of foreign navies be desirable—and I think it is—and if, as I have said, the officer ought also to have at his fingers' ends a number of "ologies," which warrant officers and men need know little or nothing of, it becomes clear that modern conditions demand for the naval officer not only improved general education, but, in addition, methods of professional education very different from those which sufficed a hundred years ago, when everything was comparatively simple, when progress was slow, and when naval material was much the same in every service. What, then, has been done to meet the demand? What has the Admiralty done to secure that its *protégés* shall have improved general education, such as will place them intellectually at least as far above the seamen as were the officers of the last century? What has it done towards introducing methods of professional education that are adequate to fulfill modern requirements?

The future officer is, as has been shown, "caught" at an age which ranges in various cases between thirteen and fourteen and a half. Any other English boy of similar social position would be then going to spend four or five years at a public school, as a

preparation to proceeding to one of the universities, or to qualifying for the army, the law, the medical profession, or holy orders. We may take it, indeed, that ordinary sons of English gentlemen have at least six years of steady and systematic education of one sort or another still before them at the age when, in the case of the boy destined for the Royal Navy, general education may be said to end. It does not cease nominally and literally; the child continues to learn French, for example, and the "outlines of English history," but the nature of his progress in French may be gathered from the fact that not one British naval officer in ten—probably not one in twenty—can at any period of his life sustain in an intelligible manner a five minutes' conversation in that language, and that the vast majority cannot understand it at all when it is spoken currently by a Frenchman. There is no suspicion of an attempt to teach any other foreign tongue, or to cultivate even the English language and literature; and my friend Mr. Gardiner's excellent "Outlines of English History" supplies but a small amount of polite knowledge wherewith to face the world. On the other hand, the child is fed on Euclid, algebra, trigonometry, nautical astronomy, navigation, seamanship, and teaspoonfuls of natural science; and his brief two years in the Britannia do not, it must be admitted, allow of his infant capacity digesting much beyond these somewhat uninviting cates. So far as it goes, I believe the Britannia to be as fine a school as exists in either hemisphere; and if you must catch your officers while they are still children, and stop their mental growth, except in one direction, at the age of fourteen or thereabouts, the Britannia cannot be improved upon as a receptacle for them during the ensuing two years. But the system does not, and cannot, provide Great Britain with officers possessed of the general education and reading that men destined for such varied and responsible duties as British officers have to undertake ought to possess; nor, as will presently be seen, is it a satisfactory introduction to even a good professional education. But first, by way of comparison, let me say a word as to the French system.

In France, the Borda, at Brest, corresponds with the British Britannia at Dartmouth; but for entry to the Borda the lowest age is fourteen, and the highest is eighteen, and it may safely be said that the mean age of admission to the Borda is upwards of three years later than the mean age of admission to the Britannia. It

was not always so. The limit of age in France used to be sixteen; but even then the mean difference was nearly two years, and the entrance examination has always been a much more formidable affair in the Borda than in the Britannia. The candidate is required to exhibit something more than an elementary acquaintance with mathematics, with the sciences, with history, with geography, with English, and with literature; and so searching is the enquiry that there are generally more rejected than selected applicants. As the able writer, who calls himself "Marc Landry," says: "The English remain of opinion that the career of a sailor demands a special initiation which can only be effected in infancy, and they still believe that a seaman worthy of the name needs a long apprenticeship, which must be begun in extreme youth. We in France used to be of the same mind, but we have modified our views in proportion as the development of nautical science has modified the conditions of sea-service. Thus, little by little, we have extended from sixteen to eighteen years the maximum limit of age for admission to the Naval School; and we are now persuaded that, though special initiation and long apprenticeship are necessary for sailors in modern fleets, they need not be entered upon in babyhood. What ought our naval officer of to-day to be? A gunner, a torpedo-man, a scientist, an engineer. His peculiar business is with science, and with solid science, and it is only from studies that are classical in the widest use of the term, and that are pursued with method and deliberation, that a young man can acquire the scientific equipment necessary for his ultimate development into a good naval officer. We have therefore done well in extending the limit of age. The reform enables us to examine the candidate searchingly, and to obtain a real guarantee as to his intellectual culture and his scientific knowledge." After two years in the Borda, the young Frenchman spends a year, before he proceeds to sea, at the École d'Application, at Paris. He does not, in practice, often go afloat before he is twenty. Our boys, on the other hand, go when they are sixteen.

I may here interject the fact that in Germany the maximum age for entry is also eighteen, and, indeed, add that in no country save Great Britain are boys of tender years now withdrawn from ordinary school studies as a condition precedent to becoming naval officers.

It may be said that the British cadet's ordinary school studies do not cease either when he enters the Britannia or when he leaves it. But to say this is surely to trifle with the truth. The boy's education, from the day when he goes to Dartmouth, is essentially special and technical. It is not of a kind to fit him to shine in general society; it is almost exclusively directed to making a mere sailor of him. When he quits the Britannia and goes afloat, he is put under the charge, so long as he remains a cadet or midshipman, of a naval instructor, who is his schoolmaster. But still, such teaching as there is, is mainly technical, and there is, comparatively speaking, very little of it. All kinds of things—such as bad weather, duties on deck, sport on shore, regattas in harbor, or presence in interesting ports—are allowed to interfere with the daily school routine. But even supposing the regulations to be always carried out in the most unflinching manner, they do not in the least tend to improve the general education of the youngster. They, and the circumstances of his life make him, I admit, a fairly good seaman, and a healthy, hearty, happy-go-lucky fellow, but they do not make him a man of the world, nor a sound, scientific officer. His technical examinations in the early part of his career are as often as not sheer shams. As an acting sub-lieutenant at the Royal Naval College, Greenwich, his studies are again purely technical, and the examinations are by no means so serious as to require an ordinarily intelligent youth to spend his whole time in preparation for them. The result often is that, being within easy reach of the dissipations of London, he succumbs to their temptations, gets into pecuniary difficulties or worse, and lays up for himself troubles which hamper him for many subsequent years. Six months' study at Greenwich, one month in the Vernon, a short course in the Excellent, and two months' final instruction in pilotage are expected to complete the qualifications of an officer for service as a lieutenant. Very few young officers, indeed, fail to pass in some kind of way the examinations which follow each course, and this fact proves, I think, that the examiners are not too exacting. The lieutenant, unless he choose to devote himself to a specialty, such as gunnery, need study no more. The way to the highest ranks in the service is already open to him. He may, on the other hand, study at Greenwich or elsewhere, if he can find opportunity, and obtain permission to do so, but he is

not obliged to; and if he go to Greenwich as a lieutenant, a commander, or a captain, he will not find there any assistance towards resuming that general education which he had to bring to an end when he was a child of fourteen.

The issue of it all is, I do not hesitate to say, that, even as a purely technical product, the British officer often compares most unfavorably with foreign officers. Nor do I wonder at it. He had no sound elementary substructure of general education: they had. He began his technical studies when he was too inexperienced to do justice to them: they did not. He continued his technical studies amid difficulties and distractions: they studied amid happier conditions, in that they received a greater proportion of their education ere they went to sea. And in the matter of general knowledge and social experience the British officer too frequently remains much where his fifteenth year left him. Of course, men of exceptional energy do advance themselves beyond that point, but such advance is rather rare; and it would be strange if it were otherwise, for the British naval officer has little leisure for study or reading, thanks to, among other things, a traditional system which requires that, no matter whether a ship be in a howling cyclone or in the most peaceful and landlocked haven in the British Isles, watch must be kept with unvarying persistency. I have, I confess, a pious opinion that, when a ship is lying, for example, at Portsmouth on a fine day, better employment might be imagined for a lieutenant, who had to leave school at fourteen, than pacing up and down a bridge, telescope in hand, for four hours at a stretch. That kind of exercise is beneficial, in a small degree, to health, but the time, in which I suppose the country retains some interest, would surely be better occupied if the poor martyr to routine were to cede his place to an intelligent petty officer and retire to his cabin to read Commandant Z—— and H. Montèchant's "Essai de Stratégie Navale"; the last number of the "Revista Marittima"; the latest circular from the Naval Intelligence Department, or a Russian grammar.

But the Admiralty in its wisdom does not actively encourage anything of that kind. It does not furnish officers with foreign technical books or magazines; it does not oblige anyone to study the circulars of its Intelligence Department; it offers no inducement worth mentioning to an officer to learn a foreign language;

and it does not even ensure that such books as are supplied to the officers' or station libraries of men-of-war shall be available for the use of those for whom they are ostensibly intended. The recent institution of a station library—a library, that is, of books bearing upon the station for which a ship is commissioned—was an excellent move, but its effects have been neutralized by the Admiralty's failure to secure that the library shall ever be opened. Boxes containing these station libraries have been sent on board her Majesty's ships of war and returned to shore again unfastened. Why? Because to this day probably half the officers of the Navy are ignorant that such a thing as a station library is ever provided, and because it seems to be a maxim on board British ships never, if it be possible to avoid it, to open anything which you will have to shut up again.

I do not blame the British naval officer when I assert that he is not what he ought to be, and that in scientific as well as in general attainments he is far behind his French, his German, his Austrian, his American, his Italian, and his Russian rivals; but I declare, undoubtingly, that, if he remain what he is, a great catastrophe is in store for his country. Courage, manliness, resourcefulness, natural aptitude, high honor, all these virtues I grant him in perfection, but they do not make him what he should be, nor what he must be, if the ancient pretentions of his country are to be maintained.

Critics of my former writings on the British Navy have charged me with pessimistic depreciation of it. Permit me to say that, if only you properly appreciated yourselves, your verdict would be more severe than mine. It could not, in any case, be more sincerely rendered or more amicably intended. But you never do and never will properly appreciate yourselves, unless a friend holds up for you a mirror, or an enemy lets you see your shadow disagreeably outlined on the smoke of his guns. You are the ostrich among the great powers; and I mean no depreciation of your many admirable qualities when I add that you are an extremely stupid and perverse ostrich. All the world can see your most salient shortcomings. But you bury your national head in the fact that you are British, and try to think that that little circumstance blinds the universe to every one of your weaknesses. It is a great and proud thing to be British; but to be trade-marked "British"

guarantees nothing in these unscrupulous days, especially in foreign countries. I do not buy a "British" penknife without having first tried its temper. And even to be British does not argue that you, individually or nationally, are better than, or even as good as something that is French, American or German. You still cling to the dangerous idea that Providence looks on you with peculiar kindness, and that good luck will always compensate you for your constitutional want of forethought and method. If you like to continue your tenure of existence on such precarious terms, all I can say is that I am very sorry that some such coercion as is applied to infatuated people cannot be applied to infatuated nations. But in the meantime it is surely not unfriendly on the part of one who has the amplest opportunities of observing how you are proceeding, to call your attention to your danger. Insular always, and "know-nothing," in the old American political sense of the expression, you look with so much contempt upon everything foreign that you often will not even condescend to examine it seriously for a single moment. That an improvement is of foreign origin is with you a reason which always precludes for a long time its adoption in Great Britain. That may or may not be the reason why you persist in your obsolete system of naval education; but I may remind you that foreigners are not alone in finding fault with that system, and that among the strongest opponents of it are many British Admirals and Captains who have had occasion to discover in their own experience how unsatisfactory it is.

I have called attention to the characteristic mental activity of the French naval officer, and especially of the young French naval officer of to-day. There is very little corresponding activity in Great Britain. I receive periodically the reports of the proceedings of the Royal United Service Institution, an establishment which pretends to exist for the discussion and promotion of naval and military art, science and literature. So far as I can judge, it does the military part of its work fairly well. But it does the naval part of its work execrably. It is apparently conducted on strict quarter-deck principles. The junior officer is made to feel that it best befits him to be silent in the presence of his superiors; and, should he essay a few remarks, he is obliged so to offer them as if, forsooth, his views, although those of an active and modern officer, were of no value in comparison with the ignorant prejudices

of old officers, rusty with long years of retirement and incapable of realizing existing conditions. This snubbing of young officers has been noticed by your newspapers, and is now less openly indulged in than in the recent past; but the quarter-deck atmosphere is carefully preserved. The atmosphere ought to be that of the ante-room or mess-table. But the Royal United Service Institution is not alone in its studious repression of youth and intelligence. The Admiralty itself pursues a similar course. It is notorious that a late senior naval lord did, and that a present director of Naval Intelligence, two captains superintendent, and other officers of rank, do publicly in journals and elsewhere discuss questions connected even with the administration of the naval service; and it is equally notorious that the Admiralty, while shutting its eyes to this sort of thing, sternly refuses to permit junior officers to write or speak on questions of speculative strategy and other subjects which involve neither criticism of things that are, nor betrayal of official secrets. Junior officers are thus restrained in their usefulness and discouraged in their legitimate professional ambitions; and the impression has taken root amongst them that the man who endeavors to elbow his way out of the crowd, to bring forward a new theory, or to do any kind of serviceable work beyond the minimum which his position requires of him, is a fool for his pains. The consequence is that, while I can mention by name twenty or thirty French officers on the active list who, by their writings or contributions to the proceedings of learned societies, have aided in the progress of general scientific efficiency, I cannot, though I have quite as many acquaintances in the British Navy, mention half-a-dozen British officers on the active list who have conferred similar benefits on their professional brethren. A valuable little dictionary of "Langage Marin Anglais-Français" was a few years ago compiled by Lieut. S. R. Fremantle, R. N., in co-operation with Captain Ernest Picard, of the French Navy. The utility of such a work requires no demonstration; yet I was gravely informed by a British admiral who had, alas! much more influence than intelligence, that "this kind of thing would do the young fellow no good in his career, and that it was always a bad sign when an officer ventured beyond his duty." My comment was a verse of Racine, and the satisfied look of the old gentleman denoted that he did not understand a word of it. This was well,

for though I was hasty and indignant, I had no desire to offend. In the meanwhile the Royal United Service Institution which, on its naval side, might be of the greatest value, if only its Council and Patres Conscripti, and the Admiralty would allow such a thing, appears to have degenerated into a mutual admiration society of certain retired officers who deliver themselves dogmatically concerning things they know nothing of, and print quires of verbiage which does not advance by a single step the efficiency of the service in which they still condescend to profess a grandmotherly interest. If Nelson, say just before his appointment to the Albemarle, had ventured to read a paper on the "Strategical Situation in the West Indies" before a Royal United Service Institution such as now exists, he would have been followed by a retired rear-admiral who, knowing nothing of the subject, would have brought down the cheers of the meeting, first by his assertions of independence and lack of prejudice, and next by his covert suggestions that no young officer whatever had any excuse for daring to pretend to have any ideas or theories. The imaginary case illustrates the regretable attitude of mind among the naval fathers of Whitehall Yard, London.

Thus discouraged on all hands, the British naval officer, with a few brilliant exceptions, resigns himself to living and moving in deep and well-worn grooves. He thinks little; he speculates less; he almost fails to realize, save in a dull and general way, that some day the storm of battle will again rage around him, and that he will be expected, by an unreasonable country, to repeat the triumphs of his ancestors. The really serious aspect of his profession is comparatively lost sight of by him. Ask him how he would take such and such a ship into action. He has but a vague idea, and that idea is dimly based upon the principle of "going for the enemy." Press him a little. Ask him what provision he would make for the carrying on of the work of a ship in action, say after the wounding of the captain, navigating officer, and gunnery lieutenant, the extinction of all the electric lights, and the severance of the means of communication between the bridge or conning-tower and the engine-room and wheel. You will discover that he has scarcely thought about the subject, and that the substance of such views as he has is that somehow or other he would, he believes, manage to extemporize facilities. Catechise him about foreign men-

of-war, their engines, armor, guns, and torpedoes. He is in absolute ignorance; but he tells you that, if war should break out, he would look up these and other points. Go further. Put it to him whether he knows any British naval captains, and if so, how many, who habitually consider these questions in a really practical way, and who in time of peace, for example, clear their ships for action as they would have to clear them for action during war. I am not speaking of the conventional mode of clearing for action, as it is carried out when a ship is at target practice or in manœuvres. I mean the kind of preparation which would have to be made in the imminence of battle, when the ship might have to ram, perhaps, at high speed; when heavy shells would come on board and burst; when quick-firing gun-fire would smash up everything, and strew the decks with wreckage of wood and iron; when the protective deck, if it is to be of any use at all, must be made complete by the closing in of the engine-room; when dozens of light bulkheads would have to be removed; when it would be unsafe to leave open a single water-tight door; when the disablement of a single officer would make a gap in the executive system of the ship, and so, for a time at least, render her partially impotent; when everything in the conning-tower would be dislocated and unworkable, owing to the concussion of projectiles against the exterior; when blood and smoke would be everywhere; and when instant carrying out of orders would be trebly imperative. Make inquiries on these lines, and the results will surprise you. They may even shake your Gallio-like indifference to the subject of British naval efficiency, and incline you to perceive that there may possibly be better ways than those with which you have hitherto contented yourselves, of training and encouraging naval officers.

You have excellent raw material, the best, I sincerely believe, that the world produces. You have a race that loves the sea, that is brave, resourceful, energetic and intelligent, and that is inspired by unequalled traditions of glory. But you have omitted to adapt your methods to modern conditions, and you must do so. It is impertinent to find fault and to offer no suggestions for improvement, and therefore, although the suggestions of a very candid outsider are not likely to be favorably received by a country which is so exceedingly well satisfied with itself as Great Britain usually is, I venture to make some, hoping that perchance, on this occasion,

British prejudice and evil conservatism may be less impregnable than they often are to rough, but friendly criticism. Here, then, are a few suggestions, which, for the most part, are based upon what seem to be the best features of the systems of naval training that prevail in other countries:

1. Raise the age for admission to the Britannia to 18, and accept no boys of less than 16½ years.

2. Abolish the system of nomination for cadetships, which should be thrown open to competition.

3. Admit no candidate unless he give proof of possessing at least as good a general education as is ordinarily possessed by an English public-school boy upon going up to one of the universities.

4. Exact proficiency in at least two modern languages and in Latin.

5. Make the preliminary educational course to extend over three, instead of over two years, and divide it as follows:

First year to be spent in the Britannia as at present. Instruction to be confined to those subjects, but to more advanced forms of them, which are already taught in the Britannia.

Second year to he spent in a modern battleship attached as annex to the Britannia. Practical study of gunnery and torpedo-work to be begun, and other studies to be continued. The battleship, or a modern cruiser affiliated to her, to proceed to sea for three months every year, and to accompany the annual manœuvres, but not to take part in them.

Third year to be spent ashore at the Royal Naval College.

6. Transfer the Royal Naval College from the immediate vicinity of London to the neighborhood of Portsmouth or Plymouth, and carry it on in connection with the gunnery, torpedo, and other establishments there.

7. Abolish the office of naval-instructor and direct his work to be done by sea-going officers of the executive branch. The increased age of young gentlemen first going to sea would render the further supervision of their professional education a much less onerous business than it now is.

8. Upon the conclusion of their third year, appoint cadets, as midshipmen, to commissioned sea-going ships, and keep them afloat for two years.

9. At the expiration of the two years, examine them for the rank

of sub-lieutenant. Let the examination include certain voluntary subjects, and offer to officers who first satisfy the examiners in obligatory subjects an increased rate of pay at the rate of one shilling per diem for high proficiency in each voluntary subject.

10. Either appoint the newly-qualified sub-lieutenant to a sea-going ship for two years, or, if he be recommended by his last captain, or by his examiners for permission to take up a specialty, send him first for one year to a sea-going ship, and then for one year to the Royal Naval College and its attached schools. At the expiration of these periods, the sub-lieutenant would be not more than twenty-five and not less than twenty-three and a half.

11. Examine the sub-lieutenant for promotion to the rank of lieutenant, renewing the offer of increased pay for high proficiency in voluntary subjects, and antedating the commissions of candidates who gain special distinction in obligatory subjects, in accordance with their relative merits.

12. Subject the lieutenant, before his first appointment to any ship, to the further admirable test which is in force in Germany, where, however, the "election" takes place at the end of the fourth, instead, as is now proposed, at the end of the seventh year, when the young officer would be entering the wardroom of a ship of war.

This "election" would be conducted as follows: The name of the candidate would be proposed to all the officers of and above the rank of lieutenant who had served in the same squadron or at the college with him since his appointment to the rank of sub-lieutenant. To each of these officers, also, the reports of the candidate's previous captains would be sent. Thereupon it would be the duty of the officers to signify through their superiors, and in writing, whether or not they were willing to receive the candidate as a brother officer. Should the majority of the reports be unfavorable, the candidate would be rejected. Should a minority be unfavorable, each adverse officer would be called upon to give his reasons confidentially. These would be transmitted to the Admiralty, and would there be adjudicated on. It is fitting that officers and gentlemen should be allowed to exercise some kind of control over the selection of men whom they must live and co-operate with; and, therefore, this principle of election ought to be applied to all officers, whether executive or not, as they rise to

wardroom rank. It would timely rid the service of many worthless characters, and it would greatly conduce to general efficiency and *esprit de corps.*

13. While retaining the system of promotion by selection to the ranks of commander and captain, throw open also annually a certain number of commissions in these ranks to be competed for by examination, as follows:

Lieutenants of eight years' seniority, and possessed of recommendations from at least two captains with whom they have served as lieutenants, to be allowed to place their names upon a list of applicants for examination for the rank of commander, such examinations to be held by not less than five captains, aided, if necessary, by civilian assessors (for languages, etc.), and applicants to be dealt with in rotation and as commissions occur for competition.

Commanders of four years' standing, similarly provided with recommendations, to be allowed to place their names upon a list for examination for the rank of captain, such examination to be held by not less than five flag-officers, aided, if necessary, as before.

The promotions by selection to promotions by examination in any year not to exceed the proportion of three to two. All examinations to be in writing as well as *viva voce.*

14. No officer to be officially promoted to the rank of captain until he has been subjected to further "election," this election being, however, confined to the commanders, captains and flag-officers of the station on which he last served. Failure of election to involve, at this stage, retirement on half-pay.

15. Promotion, after attainment of post-rank, to flow as at present, but all officers remaining in any ranks, or not having been afloat for stated periods hereafter to be determined, to be retired on half-pay.

16. A service circular or periodical to be conducted by the Intelligence Department, and to be gratuitously distributed monthly to every commissioned officer in the Navy. This circular to contain not only notices of examinations, elections, promotions, etc., but also letters from all foreign stations, approved papers on scientific and historical professional subjects, diagrams, charts, drawings, etc., the whole to be written by naval officers, who

shall be paid for their work, and shall be required to sign it in full. The contents of this circular to form a possible subject at any professional examination; and captains' letters and despatches, especially those illustrative of current naval events abroad, to be, of course, included. Translations and reviews of foreign professional works to be also inserted.

17. Commissioned officers to be relieved as much as possible of such useless duties as watch-keeping in harbor, and the superintendence of scrubbing decks, cleaning guns and polishing brass-work, these responsibilities being relegated to warrant or petty officers, or to midshipmen and sub-lieutenants.

18. Commissioned ships to be, at least once a quarter, honestly cleared for action, no matter how inconvenient the business may be, and every officer to know exactly what fresh duties would be thrown upon him in the event of the disablement in action of one, two or more of his superiors, his knowledge on the subject being tested whenever the ship goes to quarters, either by day or by night.

Some of these suggestions — and I should like to add to them if I did not fear to occupy too much space—would, I am convinced, meet with cordial support from all the best and soundest elements in the British Navy. Many, on the other hand, would be strongly objected to by a considerable body of old officers. I am not sure that the objections of these officers, if they could be translated into plain English, would not resolve themselves into indignant protests against any reform of a system in which they have grown up, and under which they find it possible to wear a uniform which they could not be allowed to wear for long under the new scheme. But, whether this be so or not, I solemnly urge upon all Englishmen that reform, of a radical character, is imperatively needed among the officers quite as much as in any other department of the British Navy, if that Navy is to continue to lead the navies of the world. Your educational system is antiquated and faulty; you do not sufficiently encourage good officers; you are too tender to the weaknesses of incompetent officers; and the upshot of it all is that although your Navy looks fairly well in peace-time, it might easily go to pieces in war-time in a manner that would be not less astonishing than unprecedented. You have time, money and opportunity now. Have you no strong organizer whom you can trust to look into and deal fearlessly with the defects to which I

call attention? Or will you tell me, as you have told me before, that you must know your business best, that I have some unspeakable political object to serve, and that what was good enough for your fathers, is good enough for you and for your children? You may tell me all that and much more. Yet if you honestly search around you, you may discover other evidence than mine that "Mene, Mene, Tekel, Upharsin" is beginning to appear dimly on the corner-stone of the great British Empire. You may yet prevent the fatal words from developing. But you must not go to sleep again for many years. You must work and watch, and look forward boldly.

NAUTICUS.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

SHIPS' BOATS.*

The Board on Ships' Boats has the honor to submit the following report of the work to date entrusted to it by the Department in the order dated March 23, 1892. It is a matter of regret that more service performances of the types designed by the Board cannot be quoted, but owing to delays over which it could exercise no control, the number of boats built upon the Board's plans, and thus employed, is, at this time, limited to six. Inasmuch, however, as the reports made upon four of these seem to verify the conclusions reached by the Board, it ventures to express the hope that, at least, one boat of each class recommended may be speedly built for service use.

This will afford, absolutely, a practical demonstration of the value of the types proposed, and, relatively, will, through the resulting competition with other boats now furnished, enable the Department to decide which are better suited to man-of-war needs.

The orders under which the Board is acting direct it to inquire into "The number, class and general dimensions of boats for all the ships in the Navy with a view to secure absolute uniformity and interchangeability in boats of the same class and in all their interior fittings, and into the question of design with reference to stability, carrying capacity and all other requirements of man-of-war boats."

In order to establish a definite point from which to start, the first action taken by the Board was to ask for all the data concerning

* Report of the Board on Ships' Boats, Navy Yard, New York, January 25, 1894. This report has not been approved by the Department, and therefore represents the personal opinions only of the members of the Board, now dissolved.

ships' boats then in possession of the Department, these to include the plans of all types and classes proposed, authorized, under construction or lately built at navy yards, or, for naval uses, in private establishments. It asked, also, that naval attachés should be directed to furnish such information as might be procurable, and that the views (on designs, fittings, rig, dimensions and motive power) of commanding officers of ships in commission, and of the naval constructors, should be elicited by a circular letter. The responses to these requests were sufficiently adequate to put the Board in possession at the very beginning, of valuable data which, hitherto, had been more or less scattered, and of opinions which had been more or less vague and indeterminate. These opinions and data were given a careful examination and study and were found to show a tendency in one direction.

As might be expected, the considerations governing the number and design of boats for any given vessel are found in all cases to be based primarily upon the necessities apt to be imposed upon that vessel when it had to be abandoned under the average sea circumstances. These necessities demand that all boats should have such seaworthiness and capacity as will enable them to embark and transport safely to the nearest land, or track of vessels, all the crew and the necessary stores and provisions.

Accepting this as the essential basis, it becomes apparent at once, that the number of boats already provided for each class of every type of vessel cannot be reduced unless, in lieu thereof, collapsible life boats and rafts better in design than any which now exist, are furnished. On the other hand, the boat stowage-room of the modern ship is so limited by smoke pipes, ventilators, sponsons, etc., that any increase in the number is, in most cases, forbidden. These limitations demand, therefore, a treatment of the question which, while retaining the full number of boats that can be practically handled and stowed, will give these boats the greatest increase of seaworthiness and capacity reconcilable with other important qualities. As the simplest and first step, an increase of length has been adopted, and the smaller classes in each type have been abandoned; for it may be accepted as a truism that an increase of two feet, for example, in a boat does not increase in a like ratio, the difficulties of handling and stowage, and that the ampler carrying capacity secured does not entail a proportionally greater weight. This leads to the adoption

of classifications, some one of which is suited to every type of vessel; and, as a corollary this gives such a possible interchangeability that the substitution of a sailing launch for a steamer, or a cutter for a whale-boat or barge, necessitates changes not in davits or hangings, but in the cradles only.

This standardizing goes farther, as it provides that uniformity of plan which, as a part of all smoothly working systems, permits any ship immediately to replace, at any navy yard, boats lost or damaged, or, should an emergency arise, to take from other ships at any station, however remote, boats necessary to the work in hand.

In order to secure the best possible types for the duties expected, the Board has graded in the following rank the qualities which every man-of-war boat should possess:

1. Seaworthiness; 2. Capacity; 3. Speed; 4. Appearance.

The first and second of these qualities are essential; the others, while important, are auxiliary. Speed is, of course, an excellent attribute, but it has its limitations and is so subordinate to seaworthiness and capacity, that no construction which diminishes them to increase it, should be permitted. Given certain factors of length, beam and depth, great seaworthiness and ample capacity with high speed are not difficult to realize; and the Board hopes it has secured these to a notable degree by adopting as few hollow lines as possible, by avoiding sharp risings of floor, by extending the width of amidship section fore and aft somewhat beyond the usual practice and by increasing the beam, and, in some cases, the shear. The Board would dwell especially upon the fact that in (sailing) launches speed should scarcely be a factor at all, as it believes a launch should be a wholesome sea-boat, of as great a carrying power as can be given on the two dimensions of length and breadth, while preserving a good appearance. She is essentially a carrier, the drogher of the ship, and with any possible lines she could not, under oars, make more than three or four knots an hour. As our steamers are, as a rule, limited to a speed of 7 to 8 knots, the latter could not tow them to more than 6 knots. It is thus most unreasonable to sacrifice their serviceability in any way by giving them lines fitted for a speed neither attainable nor desirable. Stability, strength, and durability are included in seaworthiness, and here investigation proves that buoyant and light

as are our boats in comparison with foreign types, still the scantlings are usually too great.

Unnecessary size of scantlings means purposeless increase of weight, and weight is such a factor of boat efficiency that due lightness must be sought. This does not imply fragility of structure, but such a true relation of machine to its employment that there will always be a good margin of strength and durability beyond what is necessary to withstand the rough usage—the wasteful but existent rough usage—to which boats are subjected by the wear and tear of a three years' cruise. Considerations of quality as well as of quantity of material, influence this question, and imply the substitution of lighter and better wood and fastenings, reductions in the weight, and possible changes of material in all composition castings, such as breast hooks, thwart knees, box rowlocks, etc.

What may be accomplished by a judicious employment of scantlings and a rigorous inspection of material and labor is illustrated in certain results achieved by Naval Constructor Feaster, U. S. N. Taking the weights given to the Charleston as a basis, he succeeded in ten similar types of boats built for the San Francisco in reducing the total weights over 8 per cent., and this without sacrificing other necessary qualities. The weight of the Charleston's ten boats was 20,412 lbs., that of the San Francisco's ten boats 18,619 lbs., a reduction of 1793 lbs. in favor of the latter construction. In subsequent designs a still greater reduction under similar circumstances was obtained. Twelve boats of the San Francisco reached a total weight of 22,079 lbs., while on the Newark the same number of types of boats weighed only 19,324 lbs., a reduction of 2755 lbs., or in a ratio of 10 per cent.

TYPES OF BOATS.

The Board has selected for service use these seven types of boats: 1. Steamers; 2. Launches; 3. Barges; 4. Cutters; 5. Whalers; 6. Dinghies; 7. Wherries.

The changes in nomenclature, two of which, as unusual, may sound a little strange, are recommended purely on the grounds of consistency. If cutters, why not steamers; if dinghies, why sailing launches; and why whaleboats, and not barge boats? Of course the changes proposed are, in the sense of efficiency, of slight importance. At present, more or less confusion as to the

term *launches* exists; in some ships the steamers are called launches or steam cutters indiscriminately; and the launch which is a sailing boat has to be differentiated by the unnecessary term "sailing." Hence, the Board recommends the adoption of the nomenclature suggested. Should at any time electric or naphtha boats form any part of the equipment, they would be designated, somewhat strangely at first, but naturally enough after use,—as "electrics" or "naphthas."

The exclusion of the gig as a special type is due to a belief that its place should be taken by a whaler similar in design and equally efficient as other whalers, such differences as its special assignment seems to require being unessential, and confined to fittings and finish.

The retention of the barge has been advocated, and a design is submitted which will, the Board hopes, render this hitherto rather useless type fully as seaworthy as the cutter, and, at the same time, satisfy the demands imposed by the ceremonial character of its duties in port.

Except the barge and wherry, each type is divided into classes which, for purposes of identification and distribution, are grouped according to length.

The custom of giving two sizes to barges has lost its value, owing to the fact that when a flag officer or commodore shifts his flag, he is apt to find on board his new or temporary flag ship no davits to which a 32-ft. barge can be hoisted without displacing more important boats. With a 30-ft. barge this dilemma is escaped.

CLASSES.

The seven types are divided into these fourteen classes:

Type.	No. of Classes.	Lengths, feet.
Steamer	3	33′, 30′, 28′
Launch	2	33′, 30′
Barge	1	30′
Cutter	3	30′, 28′, 26′
Whaler	2	30′, 28′
Dinghy	2	20′, 18′
Wherry	1	16′

Every ship, however small, should have a steamer, and all types a wherry.

STEAMERS.

Steamers are divided into two designs, one built normally with its keel extended to the usual skag, the other built on the "turn about" principle, where the keel is somewhat shortened and the skag is omitted. It is hoped that both designs will be approved, and that in all cases where vessels are equipped with two or more steamers, one will be a "turn about." Quick manœuvring power is a desirable characteristic, and the "turn about" design submitted has, in practice, developed this and all other good qualities to such a degree as to warrant its more extended service employment.

An inspection of this design will show that the keel is carried further aft than is usual with the boats of this type. No special protection has been given the screw, because the Board believes no such necessity exists. The unprotected screw of the 39′ Herreshoff steam barge belonging to the Chicago has, so far, enjoyed immunity from accident; and, in the latest designs received from abroad, the adoption and continuance of this principle, even in the larger boats intended for ships of war, prove that special screw protection is unnecessary.

Even if such a danger did threaten, the Board holds that the vastly greater facility of handling of the "turn about," designed by the Board and given to the Philadelphia, over-balances for such use as that suggested, any moderate protection that might be given. So far no difficulty has been found with this boat.

In the report made upon her, by Captain A. S. Barker, U. S. N., commanding the U. S. S. Philadelphia, it is stated that "The steam turn about launch, which is a life-boat, is an excellent, buoyant, and seaworthy boat, her manœuvring qualities being exceptionally good, excelling in this respect all the steam launches in the fleet, for which reason alone she commends herself to the service. The boat has been in constant use since we have had her, and has done excellent work, . . . Where two steam launches are supplied to a man-of-war, I would recommend that one of them be of this type on account of her safety and manœuvring qualities."

In the tests made by the Board in November, 1892, with a crew of eight men, and allowance of coal and water (making a total weight of 1673 lbs.) this boat showed a free-board of 45 in. for-

ward, 28 in. aft, and 22 in. amidships. With 35 men seated and supplementing the above weight, a free-board of 44 in. forward, 21 in. aft, and 19 in. amidships was maintained; and with 50 men in addition to the above 1673 lbs., the steamer turned and speeded in the East River (wind and water moderate), preserving a free-board of 36½ in. forward, 22 in. aft, and 17 in. amidships.

So far as seaworthiness goes, three members of the Board who have tried her under conditions which tested this quality fairly, have no hesitation in declaring she is far more seaworthy than any other steamer of her length they have ever seen. In these trials she was run at a high speed through the most confused sea (made both by wind and the tumbled cross-wakes of passing ferry-boats) which could be found in the East River, and at no time did she ship the least water. All these tests were made under circumstances when every other steamer of her length known to them would have become so wet and so much in danger of shipping water, as to have necessitated an immediate and large reduction of speed.

Under a test for life saving qualities, very satisfactory and unusual results were secured. The machinery and passenger spaces were filled with fresh water up to the level of the rail, so high indeed that it flowed with force through the scuppers in the wash strake, and then, as an appreciable free-board still existed, over 2200 lbs. of weight (15 men) were added without submerging the boat.

These results have been partly secured by making her not a nominal, but an actual life boat. Under the rail, on each side, two cylindrical air tanks extend for a distance of 13 feet, and in the bow and stern two air-tight compartments are disposed. The square shape given to the stern affords room for one of these air-tight chambers, and thus utilizes space which generally is wasted upon a mistaken theory as to what is good appearance. Three complete water-tight bulkheads subdivide the boat and add large margin to an already secured factor of safety.

So far as classes go, the 33-ft., 30-ft. and 28-ft., both normal and "turn about," are intended for general service use. The Board hopes later to submit plans for a Vidette steamer of about 52 ft. length.

MOTIVE POWER, ETC.

The motive power and fittings recommended for the steamers are as follows :—

28 AND 30-FT. BOATS.

1. The Bureau of Steam Engineering type "B" boat engine, without air pump and with long connections (5 cranks).

2. Independent combined air and feed pump (Blake) with a return from feed pump to tanks, which is fitted with a controlling valve.

3. Auxiliary feed pump of the Worthington-Duplex type.

4. Hand pump fitted to clear the bilge. A connection from this goes through a stuffing box in water-tight bulkhead to bilge in passenger space. A syphon for bilge is not recommended, it being too wasteful of steam.

5. An outside condenser of the Keel type or made up of smaller tubes and manifolds.

6. Propeller, true screw with generatrix at right angles with axis. Diameter 27 in., pitch 46 in., helicoidal area 363 square inches.

7. Coil or pipe boiler of 6 square feet of grate surface; not less than 107 square feet of heating surface; and which while being easy of access for repairs will make steam rapidly, carry water steadily, and be relatively lighter than those now in use. The boiler fitted with a steam jet in the smoke pipe for use in emergency.

8. Coal bunkers, capacity to be 600 lbs.; and three (3) water tanks (small one under boiler, and two side tanks) combined capacity 700 to 800 lbs. of water.

33-FT. BOATS.

1. Bureau of Steam Engineering type "G" boat engine, without air pump and with long connections.

2. Independent combined air and feed pump (Blake) with a return from feed pump to tanks, which is fitted with a controlling valve.

3. Auxiliary feed pump of the Worthington-Duplex type.

4. Hand pump fitted to clear the bilge. A connection from this goes through a stuffing box in water-tight bulkhead to bilge in

passenger space. A steam syphon should be fitted to clear the bilge, but to be used only in case of emergency.

5. An outside condenser of the Keel type or made up of smaller tubes and manifolds.

6. Propeller, true screw with generatrix at right angles to the axis. Diameter 30 in., pitch 52 in., helicoidal area 439 square inches.

7. Coil or pipe boiler of 6⅓ square feet of grate surface and about 150 square feet of heating surface, which will be easy of access for repairs, will make steam rapidly, carry water steadily, and be as light as possible consistent with strength and durability. The boiler to be fitted with a steam jet in the smoke pipe to facilitate the draught in case of emergency.

8. Coal bunker capacity 800 lbs. ; and three (3) water tanks (small one under boiler, and two side tanks), capacity of all to be 1000 lbs. of water.

SAILING BOATS.

As already stated, certain considerations have been rigidly adhered to in all designs. Primarily the Board has tried to secure seaworthy and capacious types, and to avoid that useless fineness of lines whereby these are often sacrificed in a futile attempt at speeds which are not only unnecessary but impossible. Moderate dead rise, good depth and breadth, and adequate seating and working space have been sought in every class ; while such length of thwart and such depth of side between risings and gun-wales have been allotted that, at all times, oars may be handled efficiently, and sails—always bent and ready for use—may be carried and stowed properly.

The decadence of boat sailing in the Navy or its relative abandonment is due not to any diminution of its usefulness or to the decrease of seamanship or sailing desire, but almost wholly to the fact that the sails, as a rule, cannot be kept ready for use in the average boat without diminishing its usefulness under oars.

So meager is the space assigned for bent sails that in many ships the spars are carried in the nettings or whatever stowhole is obtainable, and the sails are made up neatly labeled in a cumbersome bag, and see the air only when the prudent executive has them shaken out in the sunshine to kill the mildew.

The Board recognized this difficulty from the first, and its preliminary report stated that the distance between the seat of the thwart on the risings, and the bottom of the row-locks should not be less than 11½ in. When possible, this distance might be extended, for upon this depression of the seat below the plane of oar effort depends the possibility of obtaining, with the least waste of power, the available energy exerted. When the handle of the oar moves, not on a level with the eyes, but straight in and out from the chest, the oarsman can pull better, faster, and drier, notably in a sea way; he will preserve his temper better, and be less exhausted at the finish. Still more, this depth of seat and its resultant depth of gangboard below rowlock enable the sails and spars to be stowed at all times without difficulty, a most important matter.

In most boats, the forward thwart has been seated so that the bow oarsmen can do but little effective work. The handles of their oars constantly interfere, as there is no room for their proper use; when they are not catching crabs or splashing water, they are pretending to row, faintly dipping; and on occasions, they are so crowded together and have their knuckles so rasped by the fouling of their thwartmate's oar, that they become embroiled in more or less noisy disputes. No matter how short may be the oars, the shear of the average boat compels a length of loom and blade which forbids two men being cramped together on a seat often less than three feet athwartship; and the result is that the usual bow oarsmen are practically passengers, whose effective duty is confined to handling the boat hook. As the best means of overcoming this difficulty, the Board has taken out the useless oars and thwart, disposed in the acquired space the other thwarts, carried all of these well below the oar fulcrum, and, as it hopes, improved the design so that ample room for work and comfort is given every man.

In the 28-ft. cutter the number of oars is reduced from 12 to 10; in the 26-ft. cutter, from 10 to 8; and in the whalers, normally intended to be single banked, the fittings are such that the oars can be readily double banked, should any emergency demand this manning, or should such a permanent oar-disposition, which is often advocated in the service, be finally adopted.

The general gain here in the Board boats may, perhaps, be illus-

trated by a comparison between its 30-ft. whaler and one of slightly greater length designed for the battleships of the Indiana class. Leaving out of the question the advantage possessed by the Board boat owing to its great similarity to the whalers carried by vessels in the sea fisheries, and to those employed as surf boats on our coast, the comparison will, perhaps, possess a definite interest.

Whaler.	Battleships. ft. in.	Board Design. ft. in.
Length,	30 6	30 0
Beam at forward rowlocks,	5 0	6 0
Distance between thwarts,	2 20½	3 0
Distance between after edge of thwarts and forward edge of stern,	8 7½	7 9
Breadth of boat at after edge of after thwart,	5 7	6 3
Breadth between stern benches, forward end,	2 10½	3 3
Breadth between stern benches, after end,	1 6	2 6
Distance from forward edge of forward thwart, to after edge of stem,	5 5	5 9

The calculation of these figures will prove the greater internal capacity of the Board boat on a less length; and, when it is recalled that this efficiency is further supplemented by the good height given the rowlocks, it ought to be apparent that a speed-producing factor has been obtained, as well as a greater all-around seating capacity.

DINGHIES.

Next to steamers, dinghies are the types which have so much proved their adequacy at sea and in port, as to demand a specially careful study. In harbor, often in average weather, commanding and executive officers are compelled to keep these boats hoisted and idle because of their lack of seaworthiness and capacity, and this on stations where foreign boats intended for similar duty are going to and coming from the shore in safety and comfort. The Board has therefore designed two boats of this type, one of which has already proved its value in service.

WHERRIES.

Experience at sea has demonstrated the value of a small handy boat, such as the wherry suggested by the Board. It is a favorite type with seamen the world over; it is found on board most foreign ships of war; at times, it has been supplied ships by the Bureau of Construction; and when this has not been done, officers have frequently contributed a part of their pay to buy one.

The reason for its popularity need not be sought far afield, for the small crew required, (1, 2 or 3 men) its adaptability to immediate use and compact stowage, and its general handiness and all-around merit, warranted and received the earnest consideration of the Board.

So far as other types go, not treated in this generalization, it may be added that in the launch design submitted, the Department will find not, as is so often the case, a magnified dinghy, but an able, sturdy, seaworthy boat. Capacity for the uses intended should be ample, it should be neither slow nor clumsy, and should possess such free-board and such lightness commensurate with the demands to be made upon it, as to make its employment no more difficult and no less general than that of the average cutter.

The only data in hand upon the actual service working of the board boats are those forwarded from the U. S. S. Philadelphia. These may bear quoting:

"The 2d and 3d cutters of this ship, 30 ft. and 28 ft. in length, respectively," writes Captain Barker, commanding the Philadelphia, "are excellent boats. They have a high free-board and are dry, even when filled with men as in abandoning ship. The 2d cutter has 41 men stationed in her under those circumstances, with provisions, etc., and carries them easily, her gunwales being well out of water. Under sail she is weatherly and dry. The 3d cutter has the same general good qualities. Both of these cutters have been tested under oars as well as under sail, and to the surprise of many they seemed as fast as the average of the old cutters . . . The Dinghy (20 ft.) is an excellent boat of its kind, serviceable in every way. The present sail is perhaps a little too large for her."

CONSTRUCTION.

As an anticipatory answer to criticisms, which may touch matters of design, it can only be repeated that the Board has laid down lines which it believes to be appropriate to the work expected. Whether a boat is too deep, too full aft or not full enough forward, too much rounded, or too cumbersome and wide, are questions wherein the Board has definite opinions of its own which it has tried to realize in practice. It knows its opinions are not shared by some, but as the question of design is yet hedged about by certain doubts, due to the inexactness of naval architecture as a science, it feels it must adhere to them until service practice, or still better, competitive trials with boats already designed or projected, may establish the justice or falsity of its beliefs.

In order to establish uniformity in the description of dimensions, the Board recommends that these definitions be adopted :

Extreme length of all boats (except whalers).—This is the extreme distance over stem band and rudder hangings.

Extreme length of whalers.—This is the distance from the fore side of stem band to after part of stern post at the top edge.

Extreme breadth, all boats.—This is the distance from outside to outside of planking at the top of deck or gunwale.

Extreme depth, steamers.—This is the distance from the top of deck plank at the side to the lower edge of the rabbet of the keel.

Extreme depth, sailing boats.—This is the distance from the top of the gunwale to the lower edge of the rabbet of the keel, in all cases to be taken at the lowest point.

SAILING BOATS.

The distance between the top of the thwarts and the bottom of the rowlocks should not be less than 11½ inches. The forward thwart should be placed in such a position that the bow oarsmen can help propel the boat. It will be seen by the plans appended that in all boats the breadth over the gunwale between the forward rowlocks is not less than six feet. No tumbling home of amidship topsides should be allowed. The Board does not believe that the bilges of steam cutters are the points of greatest strength, but

holds that the support given by the deck makes its plane the best upon which to receive the greatest thrust or severest strain. In pulling boats, the Board has taken the buffeting point in broadsides above the lines of thwarts and upon the moldings, because it is only through a few feet forward and abaft, where tumble home could be of service.

As a means of comparison, the weights of the boats originally furnished the Philadelphia, and of those which replace them (Board's design) may be of interest.

Boats.	Design.	Hull.	Weights in Pounds.		
			Fittings.	Spars.	Total.
30-ft. Cutter	Board	2160	232	160	2552
28-ft. Cutter	Board	1830	190	155	2175
28-ft. Cutter	Philadelphia	2130	190	210	2530
28-ft. Cutter	Philadelphia	2490	190	210	2890

This shows that the 30-ft. cutter of the Board design (total weight 2552) is only 22 lbs. heavier than the 28 ft.-cutter (two feet less length) of the Philadelphia design, and is 338 lbs. lighter than the other 28-ft. cutter (two feet less length) of the Philadelphia design. It will also be seen that the 28-ft. Board boat is in one case 355 lbs. and in the other 715 lbs. lighter. This reduction, it appears, has, so far, not affected the fitness of the boats to withstand the rough usage of sea and harbor service, and surely, has increased their efficiency.

It is not intended to have the bottoms of the launches coppered, and the bow and stern rollers should be replaced by thick metal scores. The roller pins are usually too light to withstand any strain and the difference in friction between the roller and a smooth and beveled metal score is so slight that the roller had better be omitted.

The Board has considered the various methods of construction illustrated in bent frames, but it adheres to that adopted as being best suited to naval purposes. The question of steel boats and of such special constructions as paper and folding boats is reserved for further investigation, at which time their value will be carefully inquired into. Later, the Board will also submit its ideas upon such minor constructions as punts and catamarans, and, if required, will enter into the subject of balsas.

Opinions differ widely as to the value of armament and torpedo

fittings for boats, and these can be considered definitely only under new instructions accompanied by the views of the ordnance authorities.

Extra davits to be shipped in port should be supplied for dinghies, but their disposition belongs to the inquiry embracing the handling, stowing, and securing of boats. The necessity of settling this important question is pressing, for the uniformity sought in boats will lose something of its great value should an equal uniformity and standardizing be neglected in the appliances intended for their handling.

THE RIG.

The question of boat rig is one upon which wide differences of opinion exist, and must naturally exist, even among those most competent to judge. To some degree it is a matter of special experience, of environment, possibly of temperament. The world over, boats are produced, which, by a process of evolution, are best suited to certain localities and to certain racial tendencies. These radical differences in design make equally radical differences of rig, and out of one or both, come a special aptitude and practice of boat sailing, which are apt to make the best boats of any given locality to do better work in their home waters than the best boats of other localities seeking competition with them.

Of course, certain immutable principles govern all, based upon frictional, wave and eddy making resistances, and upon the relation of moving body to impelling force; but until the inexact science of naval architecture becomes exact, it would be somewhat presumptuous to insist that any special boat or any special rig is the best. The Board fully realized this difficulty and determined upon a rig only after such study and investigation as the condition of its work permitted. Fortunately, the times fitted in fairly well for a trial of its theories with and against those of other nations. During the international competition between the boats of the warships assembled in Hampton Roads, Captain Barker, in the report partly quoted above, writes: "On the 22d inst. (April, 1893), an international boat race under sail was had in Hampton Roads, in which the 3d cutter (28-foot Board boat) was entered. Unfortunately, the coxswain failed to round the proper stake boat and was counted out; but, according to officers who witnessed the race,

our boat sailed farther and made better time than any other. Whether this was so or not, I cannot tell, but she certainly showed herself an excellent sailing craft, and I think she will compare favorably with any of the boats of the foreigners."

It may be added here as a commentary upon a misfortune which has no official record, but was as widely and as publicly known as any other event of equal importance of the time, that this very cutter outsailed, from the start, all other boats and all other types and rigs entered. The sailing rules ordered the competitors to turn the French flagship, but through a misapprehension, the coxswain who was in charge sailed to the end of the French division, and turned its rear instead of its van boat, and this when the race was well in hand. Its long lead thus became useless, and very properly it was ruled out, and the trophy went, through this error, to the English.

This speedy cutter, like the 30-ft. of the Philadelphia, was fitted with the lug-rig of the Board's design. For many years the lug-rig was a favorite one in our service, and was actually abandoned in favor of the sliding gunter only a few years ago.

Some modifications in the old rig have been made by the Board, all tending, as it knows, to greater simplicity, and as it hopes, to higher efficiency. It was moved to adopt it, because it believed that it is, for the following reasons, better fitted for service use than the sliding gunter:

1. It can be more readily handled in making and shortening sail and in "down masts."

2. It can be more conveniently and more readily stowed in the boat.

3. It can more easily be reefed down, be better repaired in case of damage to the spars, and need have none of the metal fittings which are so fruitful a source of trouble and annoyance in the sliding gunter.

4. It gives a greater sail area.

The Board recognizes the gracefulness of the sliding gunter, but believes that utility of sail power should be sought rather than grace of appearance, when both cannot be combined.

As a rule boats are sailed only when the wind is somewhat free, and as man-of-war boats should, under no circumstances be expected to indulge in the sailings or competitions appropriate to

pleasure craft, any rig adopted must be fitted to the work expected. In the opinion of the Board this is the lug.

In the plans submitted, the bowsprit is omitted in order to gain simplicity, while at the same time the disposition of the sail power is such as to give all the handiness required.

These suggestions were approved by the Department and, in compliance with the request of the Board, the cutters already mentioned were thus rigged and assigned to the Philadelphia. In the report made upon them, Captain Barker states that "there is a difference of opinion as to the proper rig, some preferring the sliding gunter and others the lug. Our experience thus far with these boats, in comparison with the old ones, favors the lug. Some, however, contend that in a very strong wind and in squally weather the sliding gunter is the safer.

In answer to this, those who favor the lug say that except in squally weather the lug is as safe as the sliding gunter. As lug sails and spars can be stowed more easily than the sliding gunter, I favor them."

Here is that difference of opinion which the Board expected to encounter and which it accepts with all respect, as being of the very nature of the conditions hedging the questions. But its experiences have been more certain and it still stands by the official opinions already submitted; indeed, it is fortified in them by the results achieved on board the Philadelphia. It believes that the lug is the right rig and that safety in squalls and heavy weather should be on its side, as sails of that cut and hoist can always be lowered, can be doused immediately; while the sliding gunter is, at critical moments, apt to bind and become dangerous.

Among the appendices, marked (S to Y), will be found the plans proposed for every boat from the wherries up to, and including the 33-ft. steamers.

FITTINGS.

Boat fittings should follow standard patterns and be interchangeable. As yet the Board has not completed its inquiry into this branch of the subject, but in important directions, it has reached conclusions which are submitted herewith.

OARS.

Oars for double banked boats should be made of ash; for single banked boats of spruce (fir). All oars should be leathered and stamped (indented) with number and initial of boat.

While in command of the U. S. S. Yorktown, the senior member of the Board was enabled to give a determinate trial to spruce or fir oars in that vessel's gig. By this he was convinced, and the Board concurs in this opinion, that in ease of handling, in diminished liability to injury, in lightness, toughness and elasticity, in short, in all the good qualities a long oar should notably possess, the spruce or fir is superior to all long oars made of other material. What seems to confirm this judgment is the information lately received from the commanding officer of H. M. S. Blake that "after trial, fir (spruce) has now been adopted for all long oars in the British service."

It will be seen that the Board has reduced the weight of oars, and somewhat shortened the length in double banked boats.

It has considered the question of spoon oars, but does not recommend them for service use. In case the Department accepts the recommendations for spruce, which is earnestly asked, a quantity of this wood should be purchased and kept in store in order that it may be properly seasoned.

BOAT HOOKS.

Boat hook staffs should be made of ash, and they should be tipped with a dull edged single hook made of finished composition.

PAINTERS.

Should be of manilla, secured by a running eye to bolt in fore sheets.

MASTS.

Masts should be made of spruce. The mast fittings and step should be of standard pattern.

Mast bands and cleats should be of finished composition; the halyard ring, sheave and blocks, of galvanized iron, save in barges, and whalers employed as gigs, where finished composition should be substituted. The proposed mast-step is a composition pipe.

The Board has had under consideration various devices, hinges and otherwise, for stepping the masts of the larger boats, but has concluded that their complexity of action and their interference with stowage and seating room, out-weigh the claimed advantages.

BOWSPRITS.

Bowsprits are abolished.

GRATINGS.

Gratings are provided in all boats for the floors of the fore and stern sheets and for the stern benches; in special types, such as barges and gig-whalers, they may also be used as floor coverings throughout. In all cases they are to be made of seasoned ash and are to be kept bright—shellac, paint and varnish being objectionable. The stern bench frames are to be well supported by stout stanchions, so constructed that the stern bench gratings will ship and unship easily.

Cushions are unseamanlike, unsightly and cumbersome; they are difficult to keep in order or to stow, and their use should be rigorously forbidden. In all boats above the dinghy class, except launches, boat cloths of a standard pattern should be substituted for cushions.

FENDERS.

Fenders for steamers and launches should be made of canvas, stuffed with finely picked oakum. These bags will be oblong, about 2 ft. 6 in. in length, 8 in. in width, 4 in. in thickness.

The forward end is secured by a lashing to a staple in the deck or rail, and the after end is hung by a lanyard which allows the fender to take an oblique position, upper edge near the rail, lower edge near the turn of the bilge; this lanyard is covered and its upper end is secured to a staple or belt so as to allow the lanyard to hang fairly up and down when the fender is over the side.

The fenders are rope-edged, and strengthening bands are sewed into the canvas at the points where the lanyards are secured. One fender is allowed each side for every 10 ft. of length of boat and fraction thereof, less than 5 ft. The bow fender should be of the same material and make, worked on a length of small wire, with an eye in each end; its shape, however, should be somewhat like

a crescent, very thick in the centre and there reinforced with a closely knitted mat. The tips are secured on either side of the bow to bolts driven in the rail, and at such a distance from the center of the stem that when the fender is needed the parts covered by the mat and nearly all of the cusps can be thrown over the stem head. When not in use it can be carried on board so as to rest upon the deck clear of the gun mount base. The permanent lashings at the tips act as hinges for the bearing portions.

Fenders for all other boats should be made of leather discs, circular in shape with a holding flap. The lanyard is spliced into the eye of the flap and is secured inboard, abreast of every thwart, with additional fenders abreast of each bow and quarter. No fender should be painted.

ROWLOCKS.

Rowlocks are of two types, box rowlocks for barges and cutters, and swivel rowlocks for the other pulling boats, save launches, which will be fitted with galvanized iron thole pins of the usual pattern.

Box rowlocks are fitted into recesses cut out of the rail; they are made of composition and are slightly enlarged at the junction of the forward side with the bottom.

Shutters, fitted with small composition chain and bolts are intended to be used with these rowlocks.

Swivel rowlocks should be fitted into sockets that are of a good thickness and thoroughly secured to the rail. The swivel should enter the hole easily and move without friction; when these details are not considered, the sockets often work loose, and the rail becomes so damaged as to need unsightly graving pieces.

HANGINGS.

The hangings should be of the standard patterns, and to be so disposed as to facilitate lowering, casting clear, hoisting and securing. To a great degree these form a part of the subject which is to be considered under the head of lowering, hoisting and securing devices, and into which the Board hopes to go later.

It is very well established, however, that the center of the hangings should not be less than 10 in. from the forward edge of stem

nor 8 in. from the stern molding. Where the hanging bolts or eyes enter the deck of steamers with air tanks, the aperture should be sealed and calked so as to prevent the ingress of water, and where they interfere with tanks, great care must be taken with their disposition, to prevent damage to the tank's buoyancy power.

TANKS.

For the present, air tanks should be made of copper, cylindrical along the sides, and comformable in shape to the bows and sterns fore and aft (except in steamers having water-tight compartments); they should be carried as high as possible, and those amidships need not be boxed. Copper, though slightly heavier than sheet iron, is recommended rather than the latter, owing to its superiority in other respects. The employment of aluminum is recommended to be tried in not less than two boats.

ANCHORS AND CHAINS.

Anchors and chains should be made of iron well galvanized and tested. The chain should be secured at its bitter end by a stout lashing to a well driven and riveted bolt in the timbers.

RUDDERS.

The Board is not yet prepared to recommend definitely rudders or tillers.

The Board reserves until later its decision on this question.

STEERING OAR CRUTCH.

Two steering oar crutches should be carried ready for shipping in every boat; one to be fitted on each quarter as in the whale-boats of the sea fisheries.

STRETCHERS

should be square and set at an angle, and so secured as to remain in place when under a strain.

BREAKERS

should be of good capacity, and fitted with a leather tip at the edge of the bung-hole in addition to a small metal faucet.

SPARE FITTINGS.

A fair allowance of these, such as shown on plans, should be furnished each boat, marked "spare fittings."

ENSIGN AND JACK STAVES.

As provided in existing regulations.

SIGNAL BAGS.

The design submitted to the Department by Sailmaker Frank Watson, U. S. N., is recommended for adoption.

LETTERING.

All fittings should be marked with the initial of the boat; the ensignia of rank and the initial of the ship to be of composition.

BACK BOARD.

To be of standard pattern and material. A tin plate with colored drawings of signal numbers may be secured to its back, but the face should be free from all extraneous decoration.

AWNINGS.

The Board has still under consideration the subject of boat awnings.

PAINTING.

Boats should be painted as required by existing regulations.

STANDARDIZING.

The necessity of standardizing has come to be recognized of such great importance, that the Board cannot fail to recommend its application not only to the fittings, but to the construction detail of service boats.

Of course, when a standard is rigorously guarded, the play of individual abilities or of certain aptitudes which might result in improvements, is apt to be checked. Yet when too much freedom is given, a confusion is sure to result which would hamper, if not destroy, the best system ever devised. Therefore, it is to be hoped that directions will be given for the careful execution of the details

set forth in this report, at least, until actual trials in service have demonstrated their value.

In the beginning, the Board also considered the suggestions made so frequently, that at least one pulling boat in each ship of above 1500 tons should be given lines which look for speed as the most important quality. The influence upon discipline and service spirit that success in boat races would surely have, was advanced in favor of this policy, and in some quarters the hope was expressed that the superiority won and held by us for so many years in such competitions was something not to be lightly surrendered. The Board gave due weight to these ideas, freighted, as they were, with patriotic impulses and service pride; but in the end, it could only recognize that its first duty was to submit designs which, with the limitations imposed, would, above all, give the greatest security to the ship and its people.

In the course of investigation, however, it became apparent that with the highest safety and the amplest capacity a fine speed could be associated; then followed the trials of the Philadelphia's cutters which fortified this belief; and so now the Board ventures to express the hope that in the usual man-of-war competitions, which are and should be entirely unlike the contests of pleasure craft, our blue jackets may still find themselves furnished with constructions that will enable their brain and brawn to gain and hold, as they have so often, the van of the racing course.

TRIALS OF STEAMERS.

Under orders of the Department, the members of the Board visited the Navy Yards at Norfolk, Va., at Washington, D. C., and at Portsmouth, N. H., the Naval Station at New London, Conn., and the private establishments of Messrs. Herreshoff at Bristol, R. I., of Messrs. Seabury & Co., at Nyack on the Hudson, and of Mr. Fearon, at Yonkers, N. Y. Trials of boats were made at Norfolk, Washington, and New London, and at the Seabury and Fearon establishments, and reports upon the New London and Fearon boats will be found in the appendices, marked (B and C).

The trial at New London was confined to the white "turn about" steam cutter brought to this country by Commander B. H. McCalla, U. S. N., in the U. S. S. Enterprise. Her dimensions

are: Length over all, 32 ft.; length on waterline, 31 ft.; breadth, 7 ft.; depth, 3 ft. 8 in. The keel extends aft 20 ft., the after body being without a skag and joining through a moderate angle a well proportioned and nearly square stern. Tanks forward and aft, and longitudinal cylindrical air chambers in the middle body make her a good life boat. Altogether, the general design is such as to produce good seaworthiness and fair capacity, the deficiency in this latter quality being due to the deficient beam and an unnecessary effort for disproportionate high speed. The trial of this boat was ordered mainly to determine her manœuvring qualities, as the condition of the boiler power precluded any speed experiment. A sufficiently high pressure could not be carried, as the boiler tubes were very thin in consequence of frequent re-rollings; the slide valves were so badly set as to give too late an admission of steam; the condenser surface was insufficient. As the mean of five runs, three below the station in relatively rough water, and two above, in a fairly smooth stream, the speed shown was 6.46 knots. A full report upon the other qualities is recorded in the appendix, marked (B), but as a matter of running commentary, the following data relating to her manœuvring powers may be quoted here. Going ahead full speed (about 7 knots), a complete turn to starboard was made in 30 seconds, to port in 31 seconds; the diameter of the turn being 60 feet or about two boat's lengths.

Turning with helm hard up and throttle wide open, the inclination (the pressure lurch) was quick for a few degrees, then steady at the angle reached. To come to a full stop from fast ahead, backing hard, throttle wide open and link thrown over at once, required 11 seconds. When going fast astern, helm amidships, the boat tended to port.

Under special instructions of the Department the Board made careful trials of a steam cutter designed by Mr. Fearon, of Yonkers, N. Y. In the correspondence accompanying the orders was included a copy of a letter, wherein under date of Nov. 16, '91, Mr. Fearon made the following proposition to the Secretary of the Navy:

"If the Department will kindly furnish me with the sized steam launch that would best suit the wants of the Department, I will agree to build said hull, together with the engine, boiler, pumps, condensers and all other necessary fittings to perfectly equip the

launch for service. Said boat and equipment to be tested by U. S. Navy officers against the best boats now in use by the Navy Department, as tenders to the ships of war. If she does not prove superior after said tests, I do not expect or wish the Department to accept her, or to be at any expense except the expenses of the officers making said tests. If proved to be superior the Department shall take her at a price that shall be equal to the cost of first-class boats of equal size and horse-power."

At the earliest opportunities the Board made the trials necessary to determine the qualities of the boat. It did not require much examination to show that the design was inferior to those already employed and was unsuitable to service needs, for it illustrated in a high degree a want of seaworthiness, capacity and appearance. The designer claimed that he was not responsible for the hull because the conditions imposed by the Department had compelled him to turn out just such a boat, and that he had been specifically limited to the constructions exhibited in certain drawings sent him by the Department. The futility of this claim is made clear in the correspondence appended; indeed, the very terms of the proposition, as shown in its opening paragraph, prove that his understanding of the Department's position is unwarranted. Mr. Fearon asked for the "sized steam launch," as he put it, "that would best suit the wants of the Department." In compliance with this request the Department, under date of December 15, 1891, informed him that the length of the launch should be 28 ft. "Should you desire," continues this letter, "the Department will furnish you copies of the drawings of the 28 ft. service launch, which would indicate details required by the service." Mr. Fearon, on December 21, 1891, asked for the drawings and for a statement as to the "horse-power usually used," both of which were duly sent. Nothing here justifies any claim that he was limited at all, except in length, to a specific design, or hampered in his treatment of any other dimensions or qualities.

Three full trials, under way, were conducted by the Board. In each trial for speed and power the inferiority of the Fearon boat in important essentials, not only to the "best boats now in use by the Navy Department" but to the average boats furnished ships of war, was apparent. The following brief summary is added because of its relevancy to the recommendation of the Board in the premises.

Course :—Both ways to eliminate wind and tide; distance, 1½ knots; mean time of run, 12 minutes; mean revolutions, 320; mean pressure, 165 lbs.; vacuum, 17 in.; mean speed of boat, 7.5 knots; slip of screw, 37.9 per cent.

So far as machinery performances go (for it may be said that both good and bad results were attained) all the data will be found appended; but this, to some degree, may be anticipated by stating that the boiler steamed freely, that the water level was maintained without fluctuation, and that the circulation seemed to be exceptionally good. Though the machinery occupies considerable space fore and aft (13 ft. 3 in.) in proportion to the power developed, still it has the advantage of simplicity in a small number of parts, one piston valve distributing the steam to the various cylinders (quadruple expansion). In addition to this, its details of construction make it easy of access for repairs or overhauling. One notable point which the Board would like to see more thoroughly developed is its keel condenser, for this is of novel design and seems to possess some advantages over the ordinary type. It consists of a nest of ⅞ in. condenser tubes, which are secured to manifolds at the ends and are let into a rectangular recess cut out of the bottom of the boat, so that the sides of the manifolds and of the tubes are flush with the outer skin. The arrangement is efficient, compact and not liable to injury.

Off-setting these good qualities are disadvantages, which, apart from deficient speed and faulty design and construction, militate against the service adoption of the boat. 1. *The excessive weight of machinery and boiler for the power developed;* 2. *The fore and aft space occupied by these;* 3. *The set of the cranks.* These are placed at an angle of 180°, thus making their handling as difficult as with single engines and causing nearly 90 per cent. of the attempts at reversing under full head-way to result in the engine stopping on the centers until the balance wheel is thrown over by hand. Under some conditions, this want of manœuvring power would, in making landings, or wherever reversing became necessary, be dangerous to life and certainly destructive to the boat. 4. *Danger of engine disablement due to the employment of only one steam valve.* Any derangement of this disables the whole system. 5. *Unprofitable increase in size and weight of machinery due to the use of an unnecessary number of cylinders to obtain the benefits of*

expansion. This also is a direct result of the employment of only one steam valve.

Accepting the self-imposed conditions of Mr. Fearon, and comparing, as he requests, his boat with those in use by the Department at the date specified, November 16, 1891, the Board has to report that the Fearon boat has not fulfilled the requirements promised, and to recommend that it shall not be bought. Every opportunity was extended Mr. Fearon to demonstrate the possibilities of his hull and motive power; the boat was brought to the Navy Yard, N. Y., for boiler tests, and the experience of the engineer experts was freely put at his disposition; at some expense the craft was taken care of during a rigorous winter, and in every trial it was subjected only to the same intelligent and fair scrutiny which would be exercised in any design private or Government, brought officially before the Board.

Some of the details of the 30-ft. "turn about" steamers are here given. Two courses, varying only in length, were selected, both being in the channel way on the south side of Blackwell's Island, East River, N. Y.

A number of runs were made over these under similar conditions of current, wind and tide. In the first trial a propeller of the following character was employed: diameter, 28-in.; pitch, 45-in.; helicoidal area, 311.36 sq. in. The mean results obtained with this screw were as follows:

COURSE, 2⅛ KNOTS.

Time (mean of four runs)		16.02 min.
Revolutions per minute		334.75
Steam pressure		195 lbs.
Vacuum		13.9 in.
Speed		7.951 knots.
Slip		35.6 per cent.
Indicated horse-power:	H. P.	11.8598
	L. P.	10.2624
Collective horse-power		22.1222

Wind, 4, NW., tide, last of ebb.

The second trial was made with a propeller of the following

character: diameter, 27-in.; pitch, 46-in.; helicoidal area, 363.7 sq. in. The mean results obtained with this screw were as follows:

COURSE, 1 KNOT.

Time (mean of four runs)	6.45 min.
Revolutions per minute	324
Steam pressure	198 lbs.
Vacuum	15 in.
Speed	8.89 knots.
Slip	27.44 per cent.
Indicated horse-power: H. P	9.6888
L. P	11.3830
Collective horse-power	21.0718

Wind, 3, SE., tide, flood.

These figures show that the substitution of a screw 1 in. less in diameter—with 1 in. greater pitch—52 square inches greater area, and with 10 less revolutions per minute (8 per cent. less slip), resulted in nearly one knot higher speed.

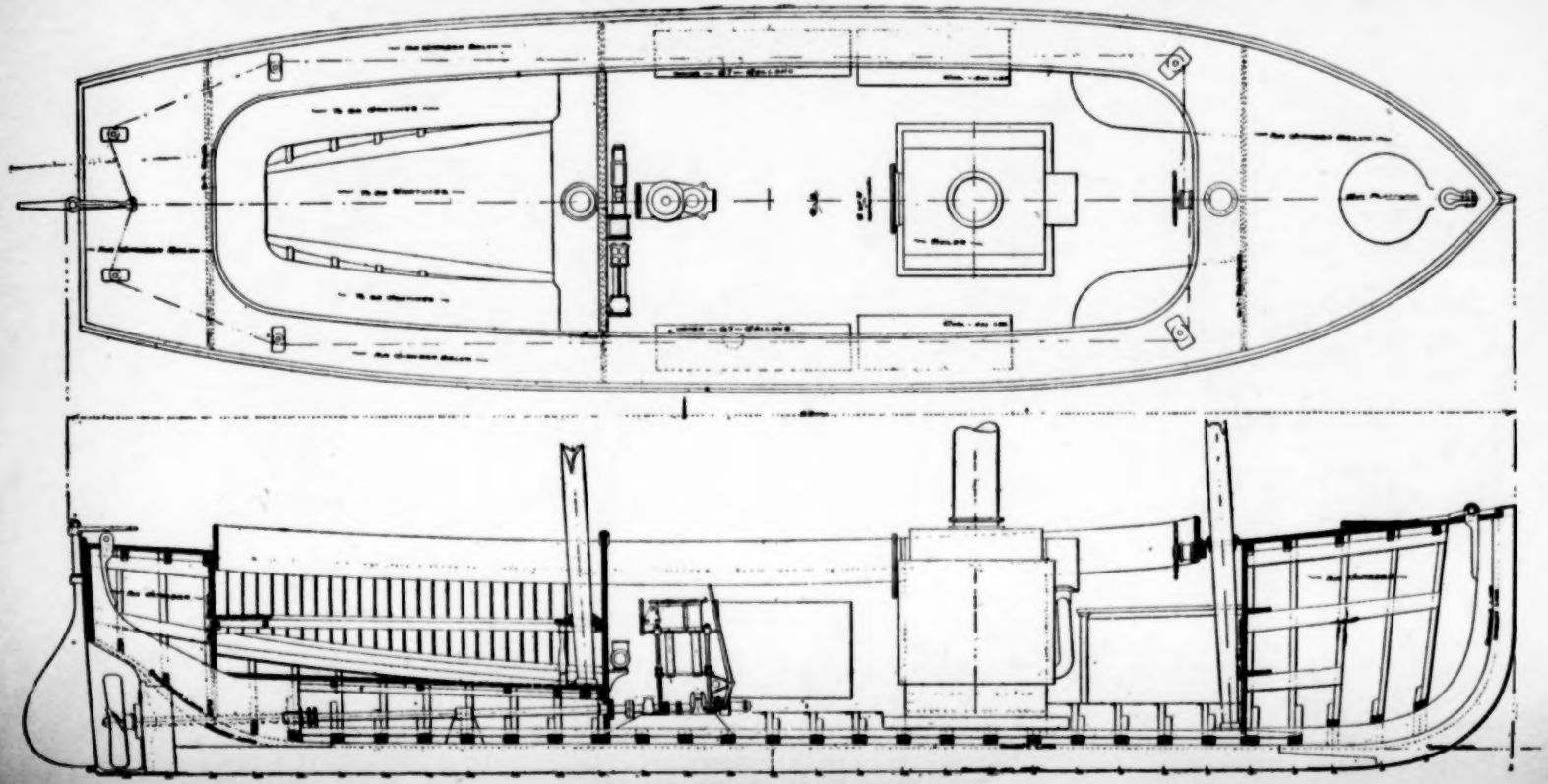
MANŒUVRING TRIALS.

From ahead fast (speed nearly 8 knots) helm a' starboard, a complete turn was made as the mean of five trials, in 28 seconds, and with the helm a' port, in 29 seconds. From full speed astern a complete turn was made, as the mean of two trials, in 1 min. and 38 seconds. A straight line astern, engines backing full speed could only be made when the helm was slightly a' port. From full speed ahead to "stop", (link thrown over at once) the time occupied as the mean of three trials was 9 seconds, the boat coming to a standstill in 16 feet, or in a little more than one-half her length over-all. During these manœuvring tests the water was smooth and the force of the wind was 3.

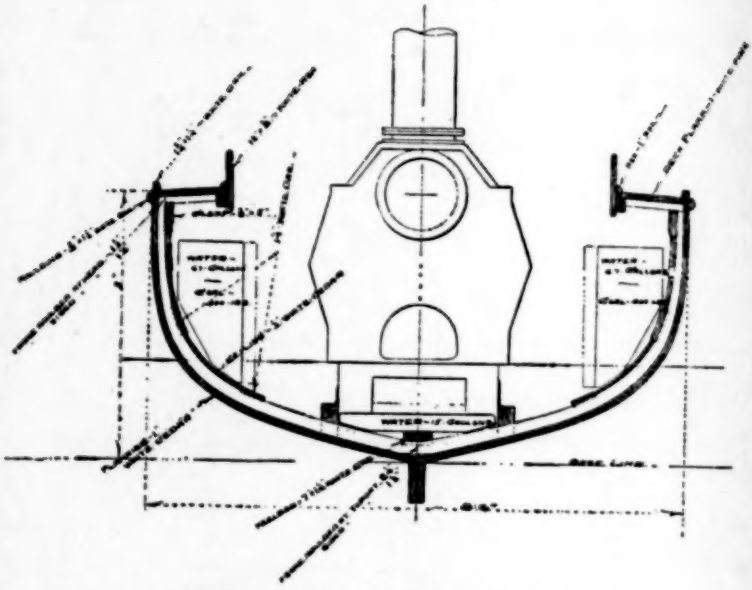
Very respectfully,

F. E. CHADWICK, *Commander, U. S. N.*,
F. L. FERNALD, *Naval Constructor, U. S. N.*,
J. D. J. KELLY, *Lieutenant Commander, U. S. N.*,
A. F. DIXON, *P. A. Engineer, U. S. N.*

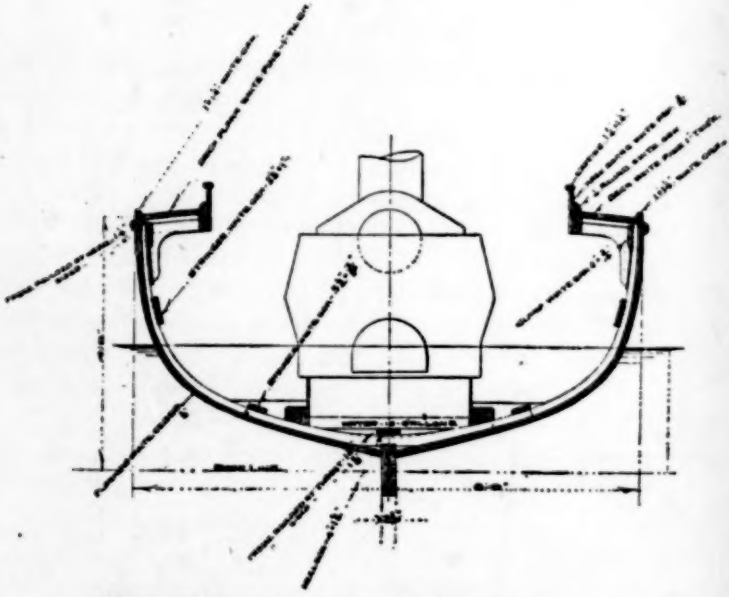
TO THE SECRETARY OF THE NAVY, *Washington, D. C.*



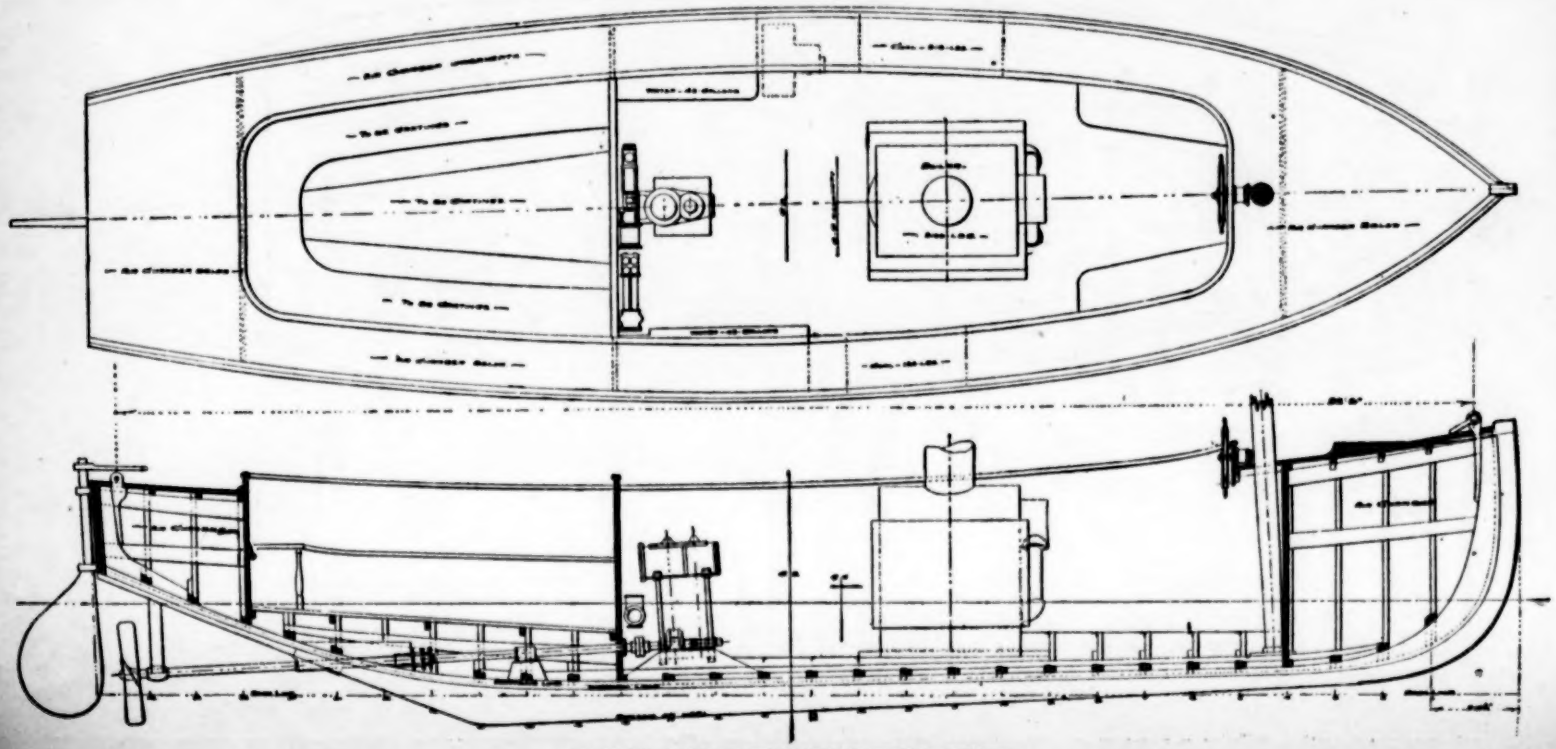
PLAN OF 33 FOOT STEAM CUTTER.



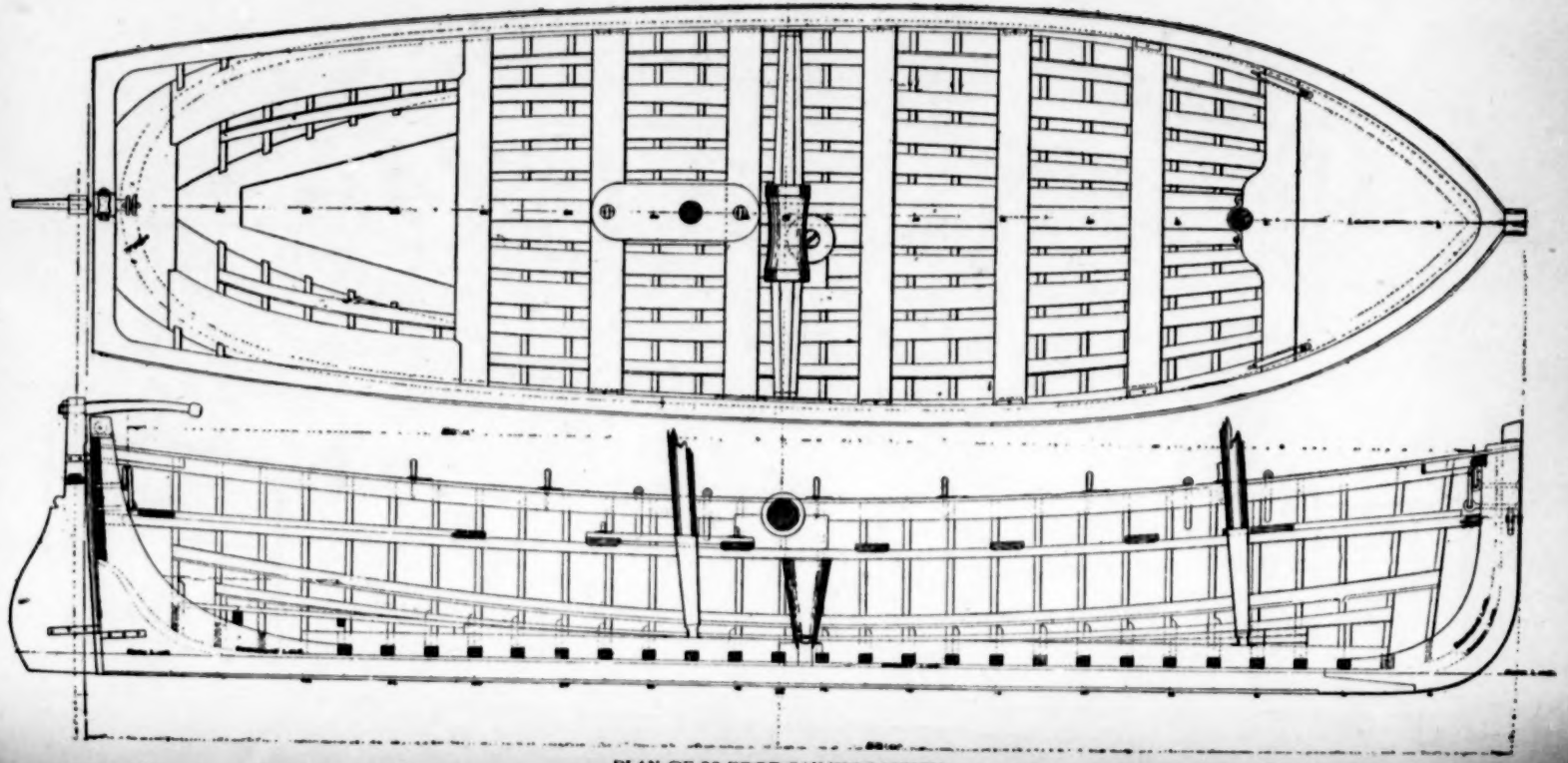
MIDSHIP SECTION OF 33 FOOT STEAM CUTTER.



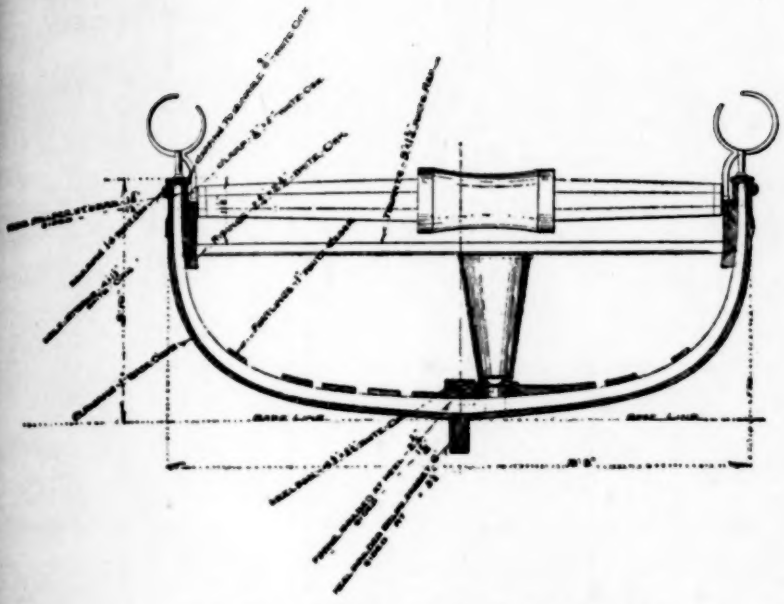
MIDSHIP SECTION OF 30 FOOT TURNABOUT STEAM CUTTER.



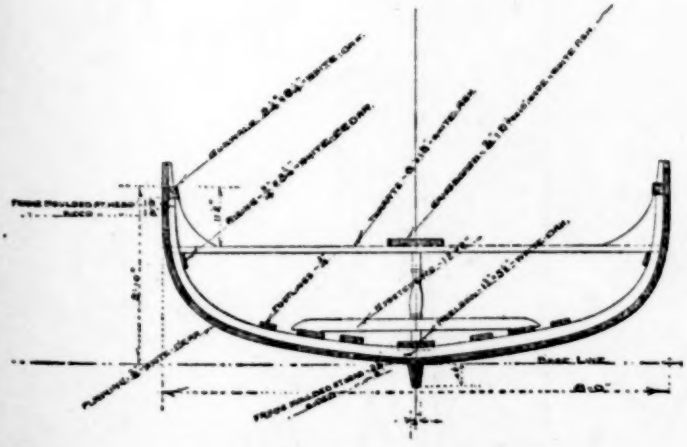
PLAN OF 30 FOOT TURNABOUT STEAM CUTTER.



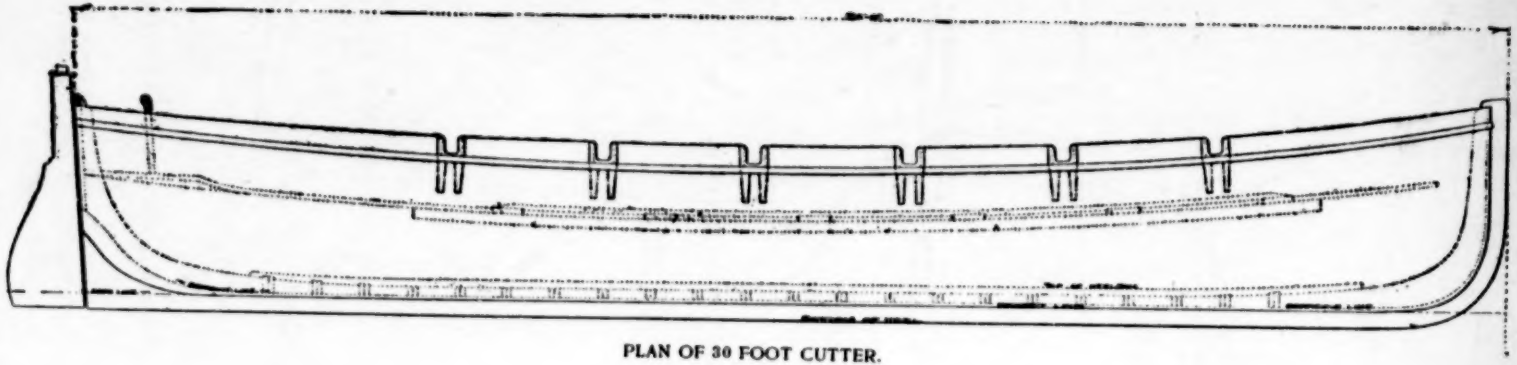
PLAN OF 38 FOOT SAILING LAUNCH.



MIDSHIP SECTION OF 33 FOOT SAILING LAUNCH.



MIDSHIP SECTION OF 30 FOOT CUTTER.



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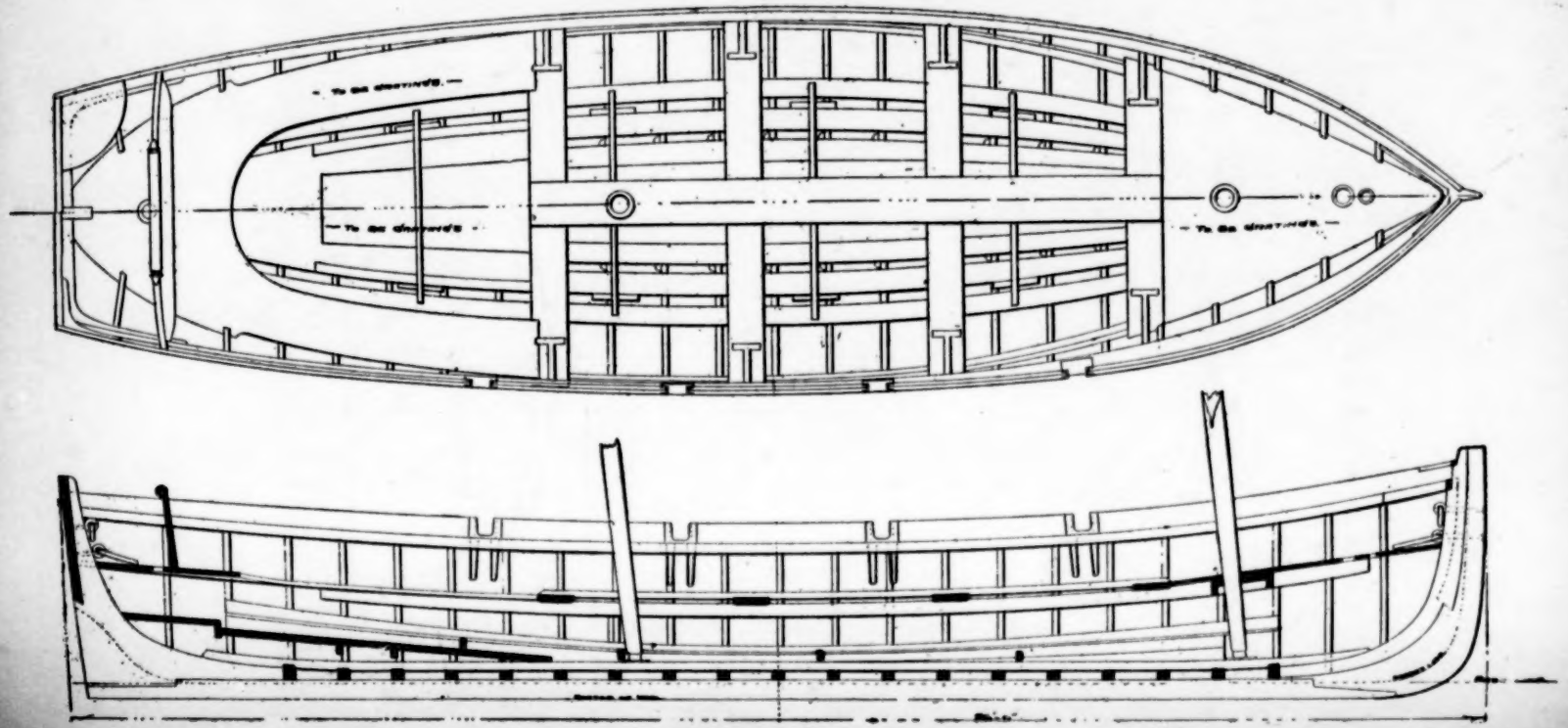

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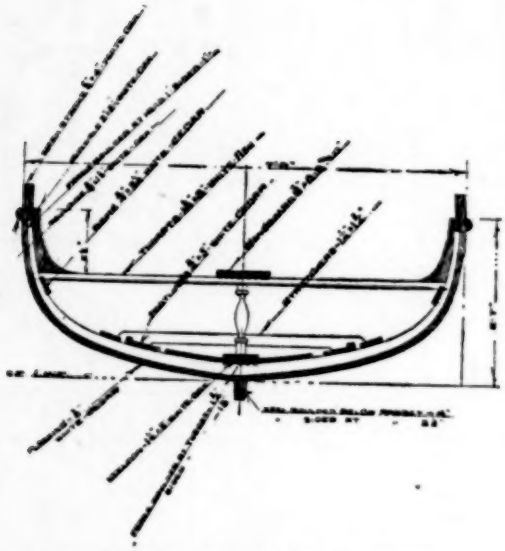

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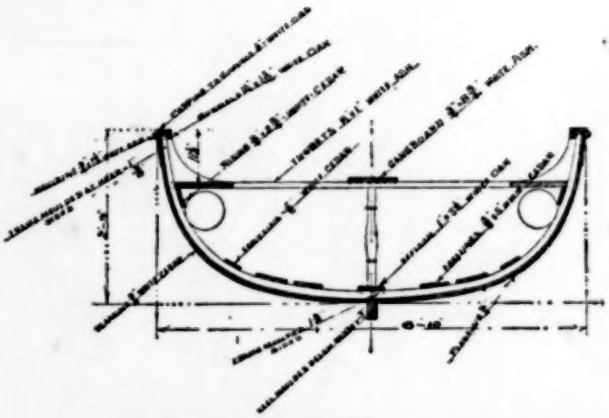
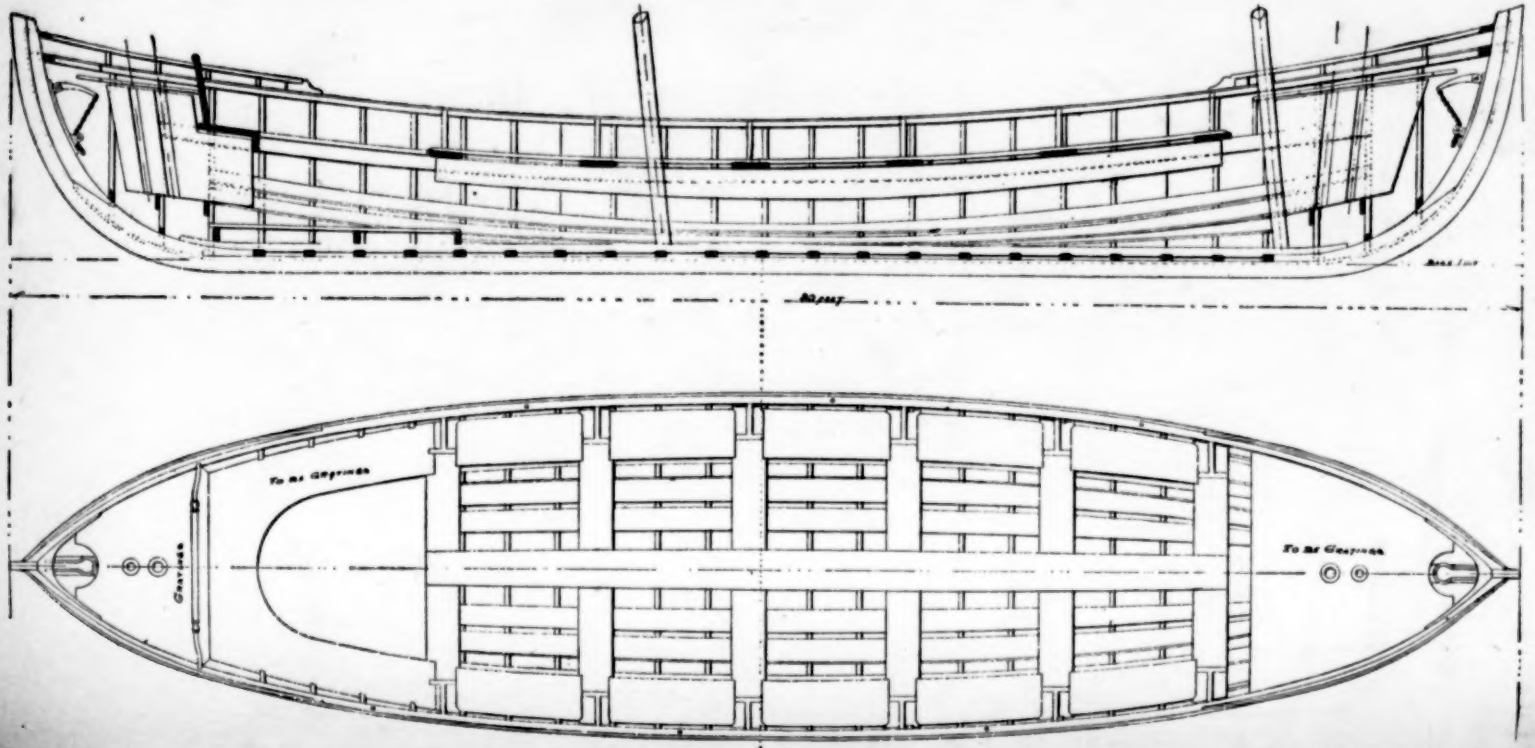


MIDSHIP SECTION OF 30 FOOT WHALE BOAT.



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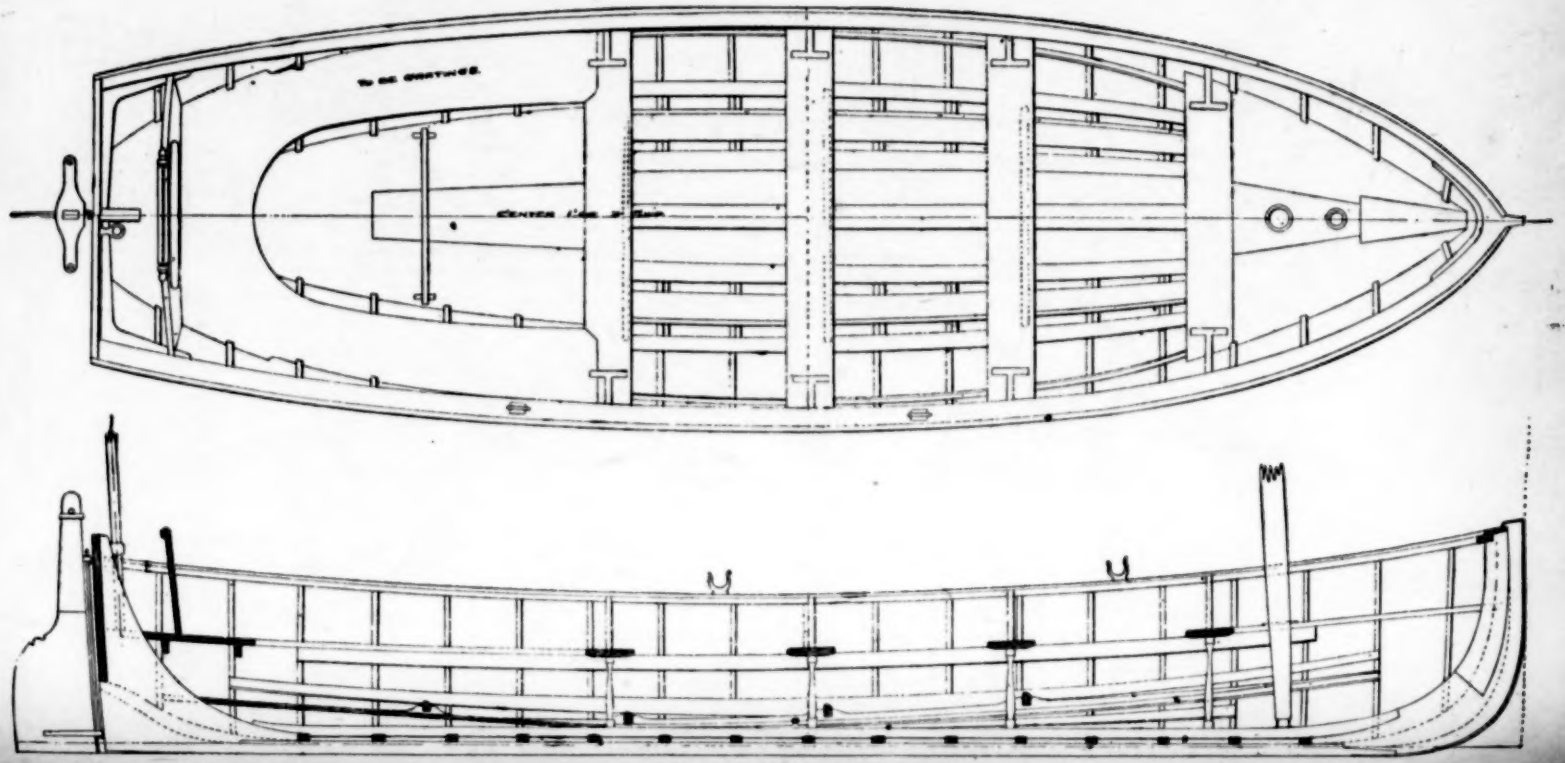

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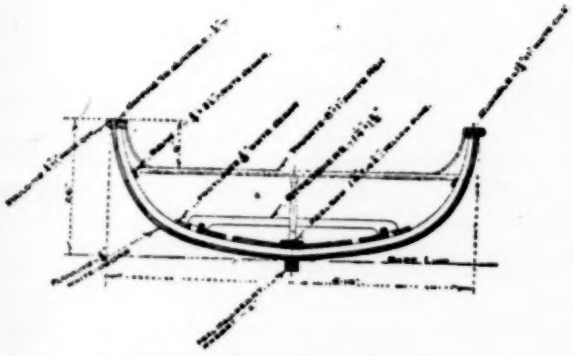

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE NAVY AND THE NATION.

By the Honorable Wm. McAdoo, Assistant Secretary of the Navy.

NAVY DEPARTMENT,
OFFICE ASSISTANT SECRETARY,
WASHINGTON, *June* 3, 1894.

Lieut. JAMES H. GLENNON, *Secretary Naval Institute, Annapolis, Md.*

My Dear Sir:—I am in receipt of your letter asking that the Institute be allowed to publish the address delivered by me at Boston, Mass., April 15, on the subject of "The Navy and the Nation." I hesitate about complying with this very kind and flattering invitation, fearing that the paper in question, which was intended for a popular audience, will seem very elementary, trite, and commonplace to a professional one. It is only justice, therefore, to the Institute as well as to myself, that it be understood that this paper is not in any sense intended for a professional audience, and that, while the statements in it are believed to be absolutely correct, it makes no pretension to critical research; more especially as regards the purely naval operations to which allusions are made.

Thanking you for the honor done me, I am.

Very respectfully,
WILLIAM MCADOO.

Although the infant republic gained its liberties against the strongest naval power in the world, it did not, for many years, seem to realize its own possibilities for contesting the supremacy of the seas. The united colonists did not possess any regularly organized navy, and their brilliant victories on the water were won by daring privateers, whose achievements are still subjects of universal admiration. With an immense continent to explore,

subdue, and develop, the energies of the American colonists were entirely absorbed on land. In the nature of things, they would not be likely to turn their backs to the west and begin contending for maritime supremacy from their advantage point on a small strip of coast bordering on the Atlantic. When the revolution, however, had been successfully accomplished, and the people began to review the valor, heroism, and prowess by which they had achieved their independence, it was impossible but that they should have been highly impressed with their possibilities as a sea power.

In the formation of the constitution by which the Confederacy became the United States, and the solid and everlasting foundations of the nation were laid, our fathers were naturally jealous of the creation of permanent military establishments. A strong standing army they deemed to be incompatible with the healthy growth of free institutions. They had seen the soldiery of the old world time and again prostituted to the ends of despotism. Their political philosophy recognized that the State rested upon the individual, and that the freedom and security of the latter were the first considerations. The man was the creator of the State, and the State lived by him and for him, which doctrine was antagonistic to the practices and teachings of older world governments, which were upheld largely by military establishments. It is quite apparent to the most superficial student of the formative period of the republic that the whole fabric of government was to rest upon the intelligence, the virtue, and the patriotism of the individual citizen. On the other hand, fresh from the military conflict with the richest, and at that time, one of the great powers of the world; with vast hordes of savages, still fierce and alert but a short remove from the coast, they did not despise the trade of the soldier. The sword had reaped the crop which the burning words of its writers and its orators had sown in the breasts of its citizens. Against the dark background of the pains and penalties of the protracted struggle, the sword flashed the Divine light of freedom. They determined to restrain its power to destroy their liberties, but they resolved to use it judiciously, and, if necessary, vigorously for the defense of those same liberties when assailed by foreign aggression or menaced by internal rebellion. Law and order, the rights of man and the rights of the State, were to be securely

defended by the militia—the citizen soldiery of the land. Every man capable of bearing arms was, in the eyes of the law, a soldier, capable of being instantly called into action. Whatever internal discords might exist, within the boundaries of the republic, were to be settled by orderly methods, and in keeping with the provisions of the Constitution; but on the national boundaries marked by the high seas for purposes of national defense and the assertion of the national rights they made the Constitution to speak with no uncertain sound, in a bold and pregnant declaration which, quoting its own words, declares among the great delegated powers the duty of Congress "To provide and maintain a Navy," omitting the proviso attached to the right to raise and maintain armies, which says, "but no appropriation of money to that use shall be for a longer term than two years."

The natural suspicion against great military establishments did not apply to the Navy. Its guns are trained upon alien enemies, and have never subverted the liberty of a country. It was with no intention of interfering in the troubled politics of other countries, or with any desire for foreign aggression, that the wise men who formed the Constitution thus declared for the maintenance ot the Navy. On the other hand, the founders of the Republic were not optimists. They had thrown off the yoke of colonial subjection. They were American not only in name, but at heart, and they were determined that our country should absolutely maintain its rights and its dignities without dependence upon foreign aid, or trusting to the good nature and sense of justice of other nations. They did not believe the latitudinarian theory that we had reached the millennium period in which high sounding rhetoric was more potent than the force of arms wielded in a just cause. They knew that until mankind had been raised to such a high general average of virtue and love of truth, the leaven of evil in even the best of communities forbids the practice of that ideal brotherhood for which we all hope and strive and pray. To show the temper of those times, I quote the Hon. Benjamin Stoddart, Secretary of the Navy, who, as early as 1798, thus expressed himself on the question:

"The protection of our coast, the security of our extensive country from invasion in some of its weaker parts, the safety of our important commerce, and our future peace when the maritime

nations of Europe are at war with each other, all seem to demand that our naval force should be augmented; so much augmented, indeed, as to make the most powerful nations desire our friendship; the most unprincipled respect our neutrality. The peaceful character of America will afford to the world sufficient security that we shall not be easily provoked to carry the war into the country of an enemy; and it will become the wisdom of America to provide a cheap defense to keep it from our own. . . . .

"Thus, in whatever view the subject is considered, whether our object be to prevent invasion, to protect our commerce, to obtain a speedy and a proper peace, to maintain peace hereafter, or, by affording security to every part of our country, to guard against the long train of ills which must result from disunion, the wisest, cheapest, and most peaceable means of obtaining the end we aim at will be prompt and vigorous measures for the creation of a Navy sufficient for defense, but not for conquest."

Later on, when the Navy had demonstrated its worth, we find a splendid vindication in our records from some of the wisest and best men of the republic.

The Hon. Langdon Cheaves, speaking in the Twelfth Congress (1811) said:

"That the subject referred to your committee in its several relations presents a question of the highest importance to the interests of the people of this country, inasmuch as it embraces one of the great and leading objects of their Government—that which, above all others, laid the foundations of the happy Union of these States—your committee need hardly say they mean the protection of maritime commerce—an interest which, though, when superficially viewed, seems to affect only the Atlantic portions of the country, yet really extends as far as the utmost limits of its agriculture, and can only be separated, from it, in the opinion of your committee, by a total blindness to the just policy of government.

"The important engine of national strength and national security which is formed by a naval force has hitherto, in the opinion of the committee, been treated with a neglect highly impolitic, or supported by a spirit so languid, as, while it has preserved the existence of the establishment, has had the effect of loading it with the imputations of wasteful expense, and comparative ineffi-

ciency. No system has hitherto been adopted which, though limited by the dispensing security of the times, and the just economy of our republican institutions, was yet calculated to enlarge itself gradually with the progress of the nation's growth in population, in wealth, and in commerce, or expand with an energy proportioned to a crisis of particular danger.

"Such a course, impolitic under any circumstances, is the more so when it is demonstrably clear that this nation is inevitably destined to be a naval power, and that the virtue of economy, if no other motive could be found, would recommend a plan by which this force must be gradually increased, the necessary expenses diminished, and durability and permanency given to the strength which they may purchase.

"That a naval protection is particularly secured to the interest of commerce by our great political compact, is proved by that part of the Constitution which expressly gave to Congress the power 'to provide and maintain a Navy,' and is confirmed by the history of the times, and the particular circumstances which led to its institution; but it is alike secured by the fundamental nature of all government, which extends to every interest under its authority a protection (if within the nation's means) which is adequate to its preservation; nor is this protection called for only by the partial interests of a particular description of men or a particular tract of country. A navy is as necessary to protect the mouths of the Mississippi, the channel through which the produce of the agriculture of the Western States must pass to become valuable, as the bays of the Chesapeake and Delaware, and more necessary than on the shores of the Eastern or the Southern States."

And Mr. Bassett, from the Committee on Naval Affairs, on November 27, 1812, thus vigorously and accurately stated the naval question:

"It is a bright attribute in the history of the tar that he has never destroyed the rights of the nation; in its defense only is he to be found. Thus aided by economy, and fortified by republican principle, your committee think they ought strongly to recommend that the fostering care of the nation be extended to the naval establishment. It is far, very far, from your committee to extend their views of a navy to the mad and wicked prospect of foreign conquest, or a silly contest to be mistress of the ocean. Their

view is limited to their own defense and to enforce respect to their just rights.

"To the objection that it is in the nature of man to run into extremes they answer that it is the end, not the beginning, we should guard against. It is surely yielding much of the argument to surrender all of the subject that is good, and require submission to evil that good may come thereof. Rather separate the wheat from the chaff—show the good and the bad. Let it be impressed on every citizen that to use force to protect and maintain the rights and liberties of his country is his first duty, while it is the greatest of crimes to attack with force the rights of others. It can require no subtlety to enforce the distinction between defense and offense; neither can it require argument to prove the first ought not to be abandoned as being more than life is worth, though the other may be deprecated as the communication of wickedness. Limited to the view of defense and protection, the committee directed their chairman to ask leave of the House to report a bill to increase the Navy of the United States."

In 1815, Secretary Crowninshield, in his report to Congress, said:

"The importance of a permanent naval establishment appears to be sanctioned by the voice of the nation, and I have a satisfaction in stating that the means of its gradual increase are completely within the reach of our national resources independently of any foreign country.

. . . . . .

"The commerce of the United States, increasing with the resources and population of the country, will require a commensurate protection which a navy alone can afford; and the experience derived from the active and vigorous employment of a limited navy during the period of the late war has demonstrated its efficient utility."

President James Monroe sums up the case after his full experience of 1812, when he states the necessity for national defense, as follows:

"If a system of universal and permanent peace could be established, or if, in war, the belligerent parties would respect the rights of neutral powers, we should have no occasion for a navy or an army. The expense and dangers of such establishments might be avoided. The history of all ages proves that this cannot be pre-

sumed; on the contrary, that at least one-half of every century in ancient as well as modern times, has been consumed in wars, and often of the most general and desolating character. Nor is there any cause to infer, if we examine the condition of the nations with which we have the most intercourse and strongest political relations, that we shall in future be exempt from that calamity within any period to which a national calculation may be extended. And as to the rights of neutral powers, it is sufficient to appeal to our own experience to demonstrate how little regard will be paid to them whenever they come in conflict with the interests of the powers at war, while we rely on the justice of our cause and on argument alone.

"Two great objects are, therefore, to be regarded in the establishment of an adequate naval force—the first, to prevent war, so far as it may be practicable; the second, to diminish its calamities when it may be inevitable. Hence the subject of defense becomes intimately connected in all its parts, in war and in peace, on the land and at sea. No government will be disposed in its wars with other powers to violate our rights if it knows we have the means, and are prepared and resolved to defend them. The motive will also be diminished if it knows that our defenses by land are so well planned and executed that an invasion of our coasts cannot be productive of the evils to which we have heretofore been exposed.

"The great object, in the event of war, is to stop the enemy at the coast. If this is done, our cities and whole interior will be secure. For the accomplishment of this object our fortifications must be principally relied on. By placing strong works near the mouths of our great inlets, in such positions as to command the entrances into them, as may be done in many instances, it will be difficult, if not impossible, for ships to pass them, especially if other precautions, and particularly that of steam batteries, are resorted to in their aid."

Thus, this prophetic band of great and good men who watched with untiring vigilance the virile primal founts of popular government, gauged with an accuracy almost incredible the scope, breadth and depth of its future progress and development. With prophetic eye they foresaw the imperial progress of our country; its magnificent and inexhaustible resources; its magical

development, and the accumulation of its incredible wealth; and, keeping pace with this increase, they could see the rise of international jealousy, the incitement of alien cupidity, and our complicated relations with other nations by reason of immense immigration. If we heartily and sincerely believed in our institutions and intended to found them as a permanent asylum for mankind, we were bound, in the nature of things, to become a menace to hereditary wrong every moment we existed. They foresaw that with long lines of exposed sea-coast, and a small but healthy and growing commerce, we would be less likely to be called upon to defend our liberties and our properties, or to assert our rights, if we took the precaution to arm ourselves on the sea rather than depend solely on the subtleties, the falsehoods, and the intricacies of a diplomacy with which, from the nature of our institutions and the form of our government, we should be illy able to compete with the masters of that art in the older world. The Navy of the United States was a slow and gradual development, for whilst the wisest of our statesmen gave it cheerful support and sincere encouragement, it was never, at any period without its opponents. The opposition to the Navy was never sharply divided by partisan lines. It was, to a large extent, geographical and sectional. Sincere and honest representative men far removed from the ocean and maritime centres, saw around them a strong and vigorous yeomanry leading the lives of soldiers and performing the duties of citizens, accustomed to the use of fire-arms, bold and fearless riders, inured to fatigue and hardships, for whom the threat of foreign invasion had but little terror. The vigorous manhood that pushed the skirmish lines of our civilization to the confines of the western ocean, as it increased in numbers, would not have hesitated to defy the world in arms in the defense of its homesteads and liberties. The great lesson that sea-power goes hand in hand with the right to rule on land was then little understood in the world. Indeed, strange as the statement may be, it is no exaggeration to say that, until within the last few years, when Captain Mahan of our Navy wrote his now universally accepted doctrine of the influence of sea-power on history, even the greatest naval nations themselves never fully realized the truths which he has so admirably demonstrated. Repressed by the vigorous hand of rigid and provincial economy, looked at coldly by

the eye jealous of military power, and distrustful of all the pomp and circumstance of war, the Navy, like the discredited heir, rose by the merit of its own virtues and the splendid heroism of its actions, under difficulties that seem to us almost insurmountable.

The American Navy substantially dates from the second war with Great Britain. It is true that it had a glorious record up to that period. Its organization had been perfected under great difficulties; with the most limited facilities, the enthusiasm, zeal, and ability of its officers had begotten a personnel second to none in the world.

Of this war itself, its causes, and its justification, nor indeed of its details, it is not my purpose to speak. I consider it second to no other in which we have engaged, in its important results upon the national character and destiny.

The Indian and French border wars formed the rough school of our soldiery. In the revolutionary struggles we developed the genius of our nationality in the arts of statesmanship. In Mexico we had shown our military prowess. In the dark days of the sixties had been settled the permanency of our institutions, the imperishable character of our liberty, the broad humanity of our people, and the essential and absolute triumph of the Union. But that which first made the Republic really and truly a nation was the second struggle with Great Britain. It would be hard to exaggerate the importance of that war which was fought by a young country, distracted by intense factional disputes and divided by sectional lines as hard and fast in their bitterness almost as those which separate the different nations of Europe. Amid these circumstances was developed to the astonishment of the world the real spirit and the true power of a democracy. The orators might wrangle, orate, and dispute. Intrigue might surround the Chief Magistrate and endeavor to divert the current of our national life, but when the common citizenship of the country understood that the struggle meant the rights and dignities of our flag on the high seas, the value of our citizenship, the freedom of our trade, our very claims to national existence and independence from Great Britain and all of Europe, the heart of the nation outburst the flimsy fetters of local prejudices and personal ambition and rushed to arms.

But, better than all, the young Republic which has been so sus-

picious of military power as to pay little or no attention to its Navy, showed the greatest enterprise as well as the invincible determination of a free people in the rapid construction of fleets, the glories of whose achievements on lake and ocean have shed lustre on our country. The American Republic, proud, invincible, imperial and regnant, took its place amid the nations of the earth on that day when the young American Navy checked the unquestioned domination of Britain upon the seas.

It is not my purpose to speak in detail of the glorious record made by the Navy in this great war. That we surprised Great Britain herself, will, I think, be readily admitted by any impartial student of history; whatever division of councils there might have been as to the wisdom of this war in different sections of our country, or in the Congress of the United States, there was absolute unity and untiring determination among the brave and chivalrous young men who then commanded our ships to win success at all hazards and in the face of all odds and difficulties. From the very start, our Navy had the swing of victory. Indeed, so frequent had victories become that the official announcement of the capture of an enemy's war vessel was told tersely, in a few lines, as if the achievement was the only possible outcome in the nature of things.

Consider for a moment that our Navy had been but rudely fostered and oft discouraged; fed upon the crumbs from the national table, and depending largely upon the fidelity and enthusiasm of its personnel, to make amends for national remissness, and that in this condition it was brought face to face with England, at a time when she did not hesitate to assert:

"Our maritime superiority is a fact; power is the law of nations. It is the right of conquerors, since men associate together to give laws to the conquered."

As is well stated by Mr. Maclay in his recent interesting history: "The British Navy was then in the zenith of its glory."

It had moved its strength against the combined navies of the greatest maritime powers of the world, and had come off a victor. In two hundred actions between single ships it had been defeated but five times, and on those occasions the British ship is admitted to have been of inferior force; but in two and a-half years of naval war with the United States, British commerce was almost annihi-

lated; and in eighteen naval engagements the Royal Navy sustained fifteen defeats.

The prophecy of Napoleon had been fulfilled. In 1802 when he parted with Louisiana, he said: "I have given to England a maritime rival that will sooner or later humble her pride."

During the war of 1812 over fifteen hundred vessels were taken from the English, and more than twenty thousand of their seamen were made prisoners. As the result of the engagements between the rival war vessels there would seem to be the most astounding disparity as to the losses on either side. The mortality on the side of the British was far in advance of that of the American, a fact probably accounted for by the demonstrated superiority of the marksmanship of our gunners. Never before in history were guns handled at sea with more precision and judgment. In addition to this, it was peculiarly a sailors' war, fought under the motto of a declaration for sailors' rights.

It is not my purpose to speak of the causes which produced this war, nor of its conduct on the part of the enemy, but I can well understand the vengeful enthusiasm with which our men took their ships into action, to force an acknowledgment of the rights of our sailors on the high seas, and often when they knew that their impressed countrymen were forced to fire upon our flag at the point of the sword in the hands of foreign officers.

Captain Isaac Hull, of the Constitution, reporting the historic action between his ship and the Guerriere, in a few words gave us a glance at the spirit of his men:

"After informing you that so fine a ship as the Guerriere, commanded by an able and experienced officer, had been totally destroyed and otherwise cut to pieces, so as to make her not worth towing into port, in the short space of thirty minutes, you can have no doubt of the gallantry and good conduct of the officers and ship's company I have the honor to command. It only remains, therefore, for me to assure you that they all fought with great bravery, and it gives me great pleasure to say that, from the smallest boy on the ship to the oldest seaman, not a look of fear was seen. *They all went into action, giving three cheers and requesting to be laid close alongside of the enemy.*"

Lay us alongside and we will do the rest. That was the temper of the Americans. We can best judge of the over-confidence of

their opponents when we state that three days before this engagement the Guerriere spoke the John Adams, Captain Fash, from Liverpool, and endorsed on her register the following lines:

"Captain Dacres, Commander of his Britannic Majesty's frigate Guerriere, of 44 guns, presents his compliments to Commodore Rodgers, of the United States frigate President, and will be very happy to meet him or any other American frigate of equal force to the President off Sandy Hook, for the purpose of having a few minutes' *tete-a-tete.*"

Captain Hull, as we have seen, thoroughly accommodated him.

I have spoken of the brevity with which our commanders announced their victories.

Commander Charles Stewart, commanding the Constitution in May, 1815, reported to the Secretary of the Navy as follows:

"*Sir* :—On the 20th of February last, the Island of Madeira bearing about west southwest, distant sixty leagues, we fell in with his Britannic Majesty's two ships-of-war, the Cyane and Levant, and brought them to action about six o'clock in the evening, both of which, after a spirited engagement of forty minutes, surrendered to the ship under my command.

"Considering the advantages derived by the enemy from a divided and more active force, as also their superiority in the weight and number of guns, I deem the speedy and decisive result of this action the strongest assurance which can be given to the Government, that all under my command did their duty and gallantly supported the reputation of American seamen."

The heroic actions of our Army having taken place largely on our own soil, witnessed by great numbers, with results immediately apparent, it is not therefore to be wondered at that our people knew more of its achievements than they did of these actions on the sea.

During this war of 1812, when our prestige on land had unquestionably suffered eclipse, and many of our citizens had become discouraged; when the blunders of commanders and the inexperience of recruits threatened national disaster and an irretrievable loss in the northwest, in the region of the Great Lakes, was it not the brilliant daring and skillful action of our Navy on these inland seas that brought joy once more to the heart of every true American? The disgrace of having our national capital burned, the false moves

in Canada, the cruelty of the enemy and his allies, were all forgotten as we watched Commodore Perry carrying his flag to victory from the Lawrence to the Niagara in an open boat, amidst a storm of missiles.

During this great naval battle the heroism of the American seamen implanted forever a love for the naval arms in the breasts of our countrymen. On board the Lawrence, which had been obliged to surrender and was again retaken, the scene was dreadful to behold.

Says a writer:

"As Perry gazed around him the decks presented the appearance of a slaughter-house. The only sounds that broke the mournful silence were the groans of the wounded and dying that came from all parts of the battered flag-ship. The decks were still slippery with blood. The masts, broken gun-carriages, dismounted cannon, coils of rope, and shattered timbers were smeared with gore, while fragments of human bodies were visible in every direction."

It was from the scene of this great action that Perry wrote his memorable dispatch: "We have met the enemy, and they are ours."

Here let me digress to say that as an additional argument in favor of the proposition now before Congress to give our officers command when young, it may be stated that Oliver Hazard Perry was only in his 26th year, and had just come from the rank of lieutenant when he fought the great battle of Lake Erie.

And my predecessor in the office which I now fill, in a treatise by him upon "The Blockade and the Cruisers," strikingly called attention to the errors of naval policy, which prevent the young and vigorous manhood of the Navy from getting full scope for their talents, and subjecting the service, as has been so well expressed by the present Secretary, to a dull mechanical movement towards promotion in place of a healthy progression, based upon merit and fitness. It is an unwise and vicious tradition, incorporated in our laws, which compels the head of a great establishment like the Navy to entrust delicate and important commands to one who has long passed the meridian of life, and whose seniority of rank is the result only of continued existence, passing by men in the prime of life, vigorous, ambitious, learned, bold, brave and eminently capable. It is essential, in order that the nation may best use the splendid material on hand, that Congressional action be taken, as has been urged by the present Secretary, to correct existing evils

affecting the personnel. In saying this I do not wish for a moment to be understood as slighting the senior officers of the service. Taken as a whole they are men of ability, ripe experience, strong patriotism, and absolutely faithful. Why should America not be proud of that splendid officer who but a day ago hauled down his official flag in southern seas and transferred the name of Admiral Benham from the active to the retired list?

Mr. Soley has well said in his book that the evils of the present system greatly handicapped the Navy at the outbreak of the civil war.

"From the fact that the Navy at this period was concerned with an essentially living and growing science, it was important that its officers, above all in the senior grades, should be men of progressive minds and of energetic and rapid action. Especially was this the case when the Navy found itself upon the threshold of a great war, in which every variety of naval operation was to be attempted, and every contrivance of mechanical art was to be employed. No doubt a war always brings new men to the front, irrespective of rank or age. But the main object of a navy's existence in time of peace is to be in a condition of instant readiness for war, and this object can only be attained by having the ablest and most energetic men in the foremost places. Unless such a provision is made, and made before war begins, the possibilities of naval development will be neglected; the vigor and audacity that should mark the earlier operations of a war will be wanting; and the opportunity of striking sharp and sudden blows at the outset will be lost.

"Unfortunately, in 1861, the arrangement of the Navy list failed to meet this essential condition of readiness for active operations. Long years of peace, the unbroken course of seniority promotion, and the absence of any provision for retirement, had filled the highest grade with gallant veterans, most of whom had reached an age that unfitted them for active service afloat. At the head of the list were the seventy-eight captains. A few of them were men of commanding talents, and these few left their mark upon the records of the war. Of the rest, some had obtained distinction in an earlier period of their career. But it is only in exceptional men that the physical and mental vigor is to be found that resists the enfeebling influences of advancing years; and it would be unjust to expect the active operations of war to be successfully carried on

by a body of commanding officers most of whom had passed their sixtieth year.

"This was, however, only one of the difficulties of the situation. The excessive accumulation of older officers at the head of the list was felt as a heavy drag all the way down to the foot. Promotion was blocked, as there was no provision for retirement; and the commanders and lieutenants, many of whom were conspicuous for ability and energy, were stagnating in subordinate positions. The commanders at the head of the list were between fifty-eight and sixty years of age—a time of life at which few men are useful for active service. The upper lieutenants were forty-eight or fifty—some indeed were past fifty—and very few were in command of vessels, as there were two hundred officers above them. The first lieutenant of the Hartford, at that time a flagship of the East India squadron, had been thirty-four years in the service. He and his contemporaries, who had entered the Navy at sixteen or thereabouts, had not yet risen to the responsibilities of command. This enforced continuance in subordinate stations could not fail to tell upon even the best men. The tendency of such a system is to make mere routine men, and to substitute apathy and indolence for zeal and energy. If a man that has had proper training is not fit for command at thirty-six, it is not likely that he will ever be fit for it. If he has reached the point of fitness, every year of postponement, unless he is a very extraordinary man, is a year of deterioration."

I pull no laurels from the brave and true men who have carried our arms with glory and renown from the frozen heights of the St Lawrence to the sunny slopes of the Mexican capital, and to the grand climax at Appomatox, but I claim for the Navy of the United States a full share in the achievements and victories of the national arms.

Many of their most brilliant victories were won on far foreign seas, bordering the coast of distant inhospitable and unfriendly nations. Oft-times in vessels of marked inferiority, with lesser guns and fewer men, thousands of miles from a friendly port, they never hesitated, while cautious and wise as they were brave, to give battle. In the din and confusion of armies contending on our own soil, with a vast number of our population far removed from the sights and sounds of maritime life, little caring for and little cognizant of these splendid exhibitions of

heroism on the water, these sea heroes plied their restless warfare, added to their immortal victories, and made us in truth and very fact the possessor of all the attributes of national sovereignty. Those who had cavilled at the expense of a navy; those who had doubted its usefulness, and those who had mistrusted its patriotism had to stand silent and abashed in the presence of these everlasting results. From that day to this the humblest craft, with the smallest crew that carries the American flag, has equal rights upon the great international highway, with those of the most powerful of the maritime and naval nations. That the Navy may not have shared in the universal encomiums which followed our arms on land, may be attributed in part to the fact that while naval actions may be pregnant with the very life of a nation, they do not involve on both sides, even when carried on by extensive fleets, anything like as large numbers as those which participate in the great battles on land.

An American battleship with a crew of five hundred men might be defending that which, if lost, one hundred thousand men could not retake, or prevent the destruction of that which a whole army could not save. The comparatively small number, therefore, in proportion to the whole population who participate in naval wars does not bring home to the scattered communities in a great country like ours the same degree of personal interest as is excited by the movement of armies.

In those vast legions which contested in our last civil war, nearly every home had a representative, and even now, thirty years after its close, in any considerable body of men aged beyond middle life, we can find representatives of the Army. The naval forces, on the contrary, which dispute for power on the sea cannot hope to have such a representation among the homes of the land. It is true that our exceedingly wise system of selecting cadets for the great naval school at Annapolis from every Congressional district is one of the strongest foundations of the organization in making its official list representative and national. I speak thus, because not only in 1812, but during our own great civil war, it has often seemed to me that justice was not done to the naval arms. In the Congress of the United States, where all questions of national policies are to be settled, a large number of representative soldiers can always

be found. Indeed, in the present Congress there are one hundred and ten ex-soldiers. It is rare that the Navy has a single representative, so that in its long and glorious history it was by no process of coddling and fondling, but by the stern performance of duty and the victories which it wrested from fate by its own right arm, that it has now securely established itself in the confidence and affections of our people. This lack of interest in or ignorance of its deeds may beget some indulgence for the bitterness of those who oppose the naval establishment, but it is hard to have patience with the statement of a representative made only four years before the outbreak of the war of 1812, on the floor of the House that "He was at a loss to find terms sufficiently expressive of his horror of the Navy. He would go a great deal further to see it burned than to extinguish the fire. It was a curse to the country and never had been anything else." A speech which begot a reply from Joseph Story, of Massachusetts, a year later, when he said, speaking on the naval appropriation bill:

"I was born among the hardy sons of the ocean, and I cannot so doubt their courage nor their skill. If Great Britain ever obtains possession of our present little Navy, it will be at the expense of the best blood of the country, and after a struggle that will call for more of her strength than she has ever found necessary for a European enemy."

The soldier who wins his battles amidst the plaudits of his admiring countrymen, and who feels that he has their united hearts behind him, is certainly less deserving of consideration than the man who maintains the honor and dignity of his flag and upholds the rights of his nationality, conscious of the indifference, if not mistrust, of his own countrymen, and in a service where the few ships were most grudgingly constructed at the national expense.

At that period of our history, moreover, when the Navy first struggled for existence, the national spirit was distracted by deep causes which eventually hurried us into a civil war. There were those who were honestly distrustful of anything that savored of collective greatness. The militia, in the nature of things, was a local organization, and in the regular Army itself the local feeling of its officers in many cases predominated over the national. On the other hand, the Navy, which carried our flag

into foreign ports where local differences and domestic disputes had to be entirely obliterated in the presence of rival nationalities, was, in its very essence, a national and not a local institution. Within the confines of the nation I yield to no man for that unyielding preference for local government and the rule of locality, but I am painfully cognizant that, however strongly we may guard our local liberties, we can never perform our rightful duty to ourselves and to mankind unless we are animated by a broad and catholic love of nationality. It is a pleasing phrase which declares the belief of many that we are on the verge of a universal brotherhood, in which the nations having nursed to manhood their struggling children will retire from the scene to commingle in fraternal embrace. I should like to believe this, but when I look around me and observe the passions, the sordidness, the selfishness, the cupidity of mankind and the cruelty of the strong towards the weak, my faith is not sufficient to discern as yet the grand millennium, the arrival of which has been so often proclaimed. I believe for myself that it will come. How many countless years it is yet distant no one can know, but that we are slowly, surely and steadily progressing to a higher plane of civilization no one can deny. The natural conflicts between the strong and the weak, the good and the bad, go on eternally, and in these contests nationality has been the most potent factor in the civilization of humanity. The man, however humble, or however ignorant, whose nation collectively has a long and noble history, cannot be wholly lost to self respect, that most powerful motive in individual advancement. The man without a nation is oftentimes the man without a character, devoid of faith in God or man. In the national workshops Providence has assigned to each different tasks, and different methods of accomplishing the same, but the sum of the united action makes for progress. It was the Divine inspiration of nationality which has ever nerved the arm of brave men to strike for liberty, to repel tyranny, to aim at the highest honor and integrity, to delve into the very secrets of nature, to overcome almost insurmountable obstacles, to endure fatigue and suffering, earn martyrdom, and challenge death. On land and sea, whatever man dares or whatever man does, the spirit of nationality hovers, demanding the highest effort, the greatest honor, and the most chivalrous action. In the study, in the field,

in the forum, in the workshop, the humblest citizen of a country feels that the greatest inventions that he can make, the noblest labors that he can perform, and the highest honors that he can reap will all inure not only to his individual advancement, but to the glory of his country and to the benefit of his countrymen. It is an incentive at once noble, catholic, and elevating. It arouses a man from the base selfishness of the shop, from the low cunning of trade, from the sharp play of partisan rivalry, from the mean vulgarities of ordinary existence, into a plane where he contends with the very gods themselves.

I invoke to-night for this great Republic, as the highest blessing with which our children can be endowed, that they be possessed forever with an intense, unyielding, strong, rugged and inspiring spirit of nationality. We are neither colonial dependents nor foreign imitators, but all Americans, proud of our country and willing to make sacrifices for her perpetuity. The war of 1812, with its naval achievements, widened the scope of our nationality, and our people began to see that what was said of the individual by the apostle, was also true of the nation. "No man liveth to himself, and no man dieth to himself." Whatever the fathers might have wanted—whatever their children might desire—it is beyond our power to secure an absolutely national exclusiveness. Our fortunes are interlinked and interwoven with those of mankind. Vast streams of humanity pour annually upon our shores, to be absorbed and amalgamated, and quite frequently to beget international friction. When American capital and enterprise have developed the material resources of our country, they are sure to venture with greater energy abroad. For the present we have almost stopped building railroads, but with the increase of population and the pressure for new fields for energy and capital we shall certainly build ships. Our society and our health itself are affected in these days of quick intercommunication by those far removed. The unsanitary surroundings of a Hamburg alley, and the oppressive measures of old world despotism, bring menace to the homes of our children and add to the social problems that meet us at our doors. I trust we shall still adhere to the language of the great Washington, to "avoid foreign entanglements," but I am quite sure that it is utterly impossible for us to escape grave and practical responsibilities in our quick communication and

increased relations with foreign countries. We may be able, by an illustrious example, to slowly teach them the lessons of justice, moderation, and peace, but the millennium is yet far away. No one disputes the justice of the Decalogue or the beneficent principles of Christianity, but Christian effort is misplaced if these obtain anything like universal recognition in the practical lives of our fellow beings, and what is true of men is true of nations.

Our vast resources, our tremendous power, our advancing civilization, whether we will or not, make us a factor in the affairs of our neighbors.

The doctrine of American ascendancy on the western hemisphere is intuitively in the minds of our people, but finds really no place on the statute book, and in our written records appears only as the patriotic sentiment of a Presidential message and a lamely passed Congressional resolution. But it needs no written parchment to give it force, and it could not be strengthened or weakened by the most exhaustive and statesmanlike debate, for it is engraved as a deep and virile sentiment in the hearts of the vast majority of the American people. It is one of those robust, national sentiments which need but the occasion to arouse an earnestness which astonishes the indifferent and makes mockery of those who sneer at love of country; the political agnostics who affect to doubt the wisdom of the fathers, and the narrow selfishness that cannot see beyond the neighboring duck pond.

We could not rid ourselves, if we would, of our responsibility to the other nationalities in both North and South America. They have not only copied our form of government, but as far as possible built their liberties upon similar institutions to ours, and in the event of invasion for the purpose of extending European influence over their affairs, they would look to us for support. We can have no desire to absorb their territories nor interfere in the slightest degree in their internal politics, but, on the other hand, the American people would resent with striking unanimity any attempt to extend European influence over these countries. We have just at present a strong illustration of a wise and firm exhibition of true American doctrine, as shown by the conduct of Admiral Benham in Brazilian waters. Our Government between the conflicting parties in Brazil maintained the strictest and most im-

partial neutrality, while at the same time, we put into Brazilian waters the most powerful American fleet, considering the modern character of the vessels, which ever represented our flag abroad, or indeed at home. It would be hard to estimate the prestige to ourselves and the confidence to our neighbors in the South which these splendid ships carried to the minds of the South Americans and foreigners who saw them in the port of Rio de Janeiro. It was a notice to the world that, while an absolute and total abstension from interference in foreign politics was the creed of our people, we were, nevertheless, keenly alive to our expressed declaration, that all the Americas are for Americans, and that our sympathies are of right and do naturally belong to those who believe in a republican form of government. Better than all, it illustrated that while we are extremely cautious and careful of the rights of others, we are never hesitating, nor timid, in asserting our own, wherever they are imperiled. With the phenomenal growth of our population, the increase of our commerce, the expansion of our capital from land to sea, there comes a stimulus from the sight of that splendid squadron, commanded by brave and patriotic officers, carrying our flag with pride over decks cleared for action, as they steamed up the bay of Rio.

When the surplus energies of our people find vent, as they will, in striving for a fair portion of the trade on the ocean, and when comes, as come it will, a return of our national and maritime supremacy, we shall not, I trust and believe, become the imitators of European governments, those international bullies who rob, under the guise of civilization and religion, the weak and ignorant, whilst evading, even to the point of humiliation, conflict with the great and powerful. Better far that we should shame them by a noble and chivalrous example into the paths of justice and equity. In the processes by which we shall reach our strength as a sea power, there will undoubtedly be many differences of opinion. For these we can have all charity, provided they are honest, patriotic and broadly national. The obligations which a citizen owes to his country are great and onerous. The splendid title of American citizenship, with its imperial privileges, proud rights and great glory, cannot be bought cheaply or held rightfully except by the fulfillment of reciprocal duties. The blessings of national greatness can only be secured

by the patriotic willingness to bear national burdens, among which is the constitutional requirement to maintain the Navy.

I have passed over its all-powerful aid to the Union cause during our late war, because I wish for the present but to scan its rise, and briefly for a moment to look at its present condition. Its new birth as a modern navy dates back scarcely ten years. Like its predecessor of 1812, it has met with no little opposition, its present opponents following mostly in the same lines as its former enemies. But, despite all this during the last few years, I am quite satisfied that the American people as a whole are earnestly desirous that the work of building a modern navy commensurate with our needs should not be delayed. In spite of manifold difficulties and misgivings, in the face of a most bitter and strenuous opposition, and absolutely without experience, the skill of our officers and the enterprise and ingenuity of our American mechanics have begotten a navy small in numbers as yet, but composed of ships inferior to none and superior to many of those of the older and more advanced naval nations. We build our own ships, we make our own guns, and we equip them with the handiwork of American mechanics. It was but a few years ago that not a single steel ship, not a modern engine, and not a plate of armor had been constructed in the United States. Under the very able and skillful administrations of the late Secretaries Whitney and Tracy, we are to-day making the best guns, the best armor, and ships and engines inferior to no others in the world. In the possession of governmental and private plants necessary to do this work, requiring machinery in large part out of the range of commercial work, we have a strong bulwark for naval defense. The mere posession of ships does not of itself constitute naval power. Against such a nation, our own, even with a lesser number of vessels, but with the capacity to construct ships not only on the Atlantic but with the splendid works now established on the Pacific, we should, in the long run, prevail. This is so thoroughly understood abroad that all the great nations of Europe create with their navy the capacity to reproduce their ships at home. Russia and Germany are now making rapid progress in the establishment of ship-building plants, as rivals to those of the two great naval nations, England and France. Our own Navy is not yet sufficient in the number of its vessels, nor

in their power and type, for the needs of our country. The demand for the services of our ships in all parts of the Pacific ocean is so great that we could almost use the entire fleet in those waters alone. Our patrol of Bering Sea, our great interests in the Pacific and in China and Japan, and the constant upheavals in Central and South America, make pressing demand for their services. We are represented by only one ship in Europe, and the North Atlantic squadron had to be taken almost entirely from its allotted province and sent to Brazil during the late disturbances there. In all this we must not forget our long and exposed sea coast, studded with cities, the riches and the least defended in the world. The true unit of coast defense is, in my judgment, the Navy. Forts rarely, if ever, stop ships, and modern warships heavily armored, carrying powerful guns, and moved with great speed by modern engines, have almost a contempt for land fortifications. Even in the days of the older navies, the fort was distanced by the ship. We all remember how the heroic Farragut took whole squadrons into bays and up rivers, bristling with land batteries, and during the late trouble in Brazil, the rebel fleet with insolence, if not contempt, ran in and out of the harbor closely studded with forts. Land fortifications of course have their use, and on the narrow and tortuous channels of many of our harbors, manned as they would be with American skill and ability, it would be very unwise and unfair for me to discount their power; but our main reliance on the sea must, of necessity, be in a well built, well equipped, well manned, and well officered navy. The future of the Republic rests on the wisdom and patriotism of its children. They are entering upon an epoch in which our country is destined to be more great and powerful than we have ever dreamed. To them the story of the dashing privateersmen of the revolution, that long list of victories in 1812, which read like a romance, the whole history of our splendid naval achievements from John Paul Jones to Decatur and Hull, and from Hull and Perry to the great Farragut, will have a new and glorious meaning. When they read of the contest where the intrepid Jones challenged an enemy of superior strength, and wrung victory from fearful odds, of the days when the Guerriere struck her flag to the Constitution, of how Perry annihilated the English fleet on the lakes, and of how the gallant Porter on the far off coast of Chili fought his little ship against superior

numbers and only yielded when destruction and annihilation had all but accomplished their work, they will be proud to be called Americans. Their pulses will beat faster, their hearts throb quicker, their faces flush with pride, and their minds take on fresh resolves for their country as they read of the Hartford steaming majestically through a hell of batteries and daring the unseen dangers of the torpedo with that great American sailor Farragut lashed to the shrouds. They will glow with honest patriotic pride, and America will seem more dear to them, when they read of how, on that summer morning off the coast of France, in the presence of unfriendly foreigners who were planning our destruction and wishing our downfall, the grand old Kearsarge challenged to mortal combat the Alabama, the destroyer of our commerce; and they will shed a tear to think of her loyal ribs torn and scarred, lying on the rocks of Roncador, while the sea birds soar around her ragged spars, her stout timbers bidding defiance to the destroying elements of nature as they did years ago to the murderous weapons of man. When we have done our duty and filled our part as best we could, in council or in camp, or in the profound duties of plain citizenship, we must leave the heritage of our country's honor and prosperity to our children and enjoin upon them the sacred task of seeing that the American Republic in all its greatness, and moral worth, in all its hopes for humanity, in all its love of liberty regulated by law and marked by order, in all its opportunities for virtue, in all its possibilities for merit, in all its regal strength among the nations, is, must, and shall be forever invincible.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

NOTES ON NAVAL GENERAL COURTS-MARTIAL,

WITH A FORM OF PROCEDURE.

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When an officer or other person is reported to his immediate commanding officer for grave misconduct, it becomes the duty of the latter (under Art. 1030 of the U. S. Navy Regulations), to institute a careful inquiry into the circumstances on which the complaint is founded. To this end he must call upon the complainant for a written statement of the case, together with a list of his witnesses, mentioning where they may be found, and a memorandum of any documentary evidence bearing upon the case which it may be in his power to produce.

He shall also call upon the accused for such counter statement or explanation as he may wish to make, and for a list of persons he desires to have questioned in his behalf.

Whenever an accusation is made against an officer, either by report or by indorsement upon a communication, a copy of such report or indorsement shall be furnished at the time to the officer accused (Art. 1035).

If, upon investigation, the commanding officer shall be satisfied that the charge is such as to call for a general court-martial, he shall transmit to the Secretary of the Navy, or to the commander-in-chief of the fleet or squadron, as the case may require, a detailed statement of the misconduct with which the accused is charged, together with lists of witnesses in the case (Art. 1033).

The person accused shall be furnished with a true copy of the charges, with the specifications, at the time he is put under arrest (Art. 43, "Articles for the Government of the U. S. Navy").

Should it be decided to bring the accused to trial, the court shall be assembled for that purpose as soon as the nature of the case and the interests of the public service will allow (Art. 1034).

The limitation of time for ordering a trial is two years after the offense was committed, unless by reason of some manifest impediment the accused shall not have been amenable to justice within that period. The limitation in cases of desertion begins to run at the end of the term of enlistment of the offender (Art. 1038).

The power to convene a general court-martial, the composition of the court, the method of drawing up the charges and specifications, the duties and privileges of the members and judge advocate, and the method of conducting the trial and keeping the record are given in "U. S. Navy Regulations, 1893" (Art. 1780–1876).

The order convening the court is addressed by the convening authority to the senior member of the court, who becomes president thereof by virtue of his rank.

A letter is addressed to the judge advocate and one to each of the members, directing them to report to the presiding officer of the court at a place and time specified. These letters, or orders, are signed by the convening authority, or the Chief of Bureau of Navigation when a trial is conducted at shore stations, or on board vessels in the waters of the United States: but on foreign stations they are signed by the commander-in-chief of the fleet or squadron.

The original charges and specifications are sent to the judge advocate, together with a letter of transmittal, all of which must be appended to the record of the proceedings of the court. They are signed by the convening authority.

A duplicate original of the charges and specifications is transmitted by the convening authority to the accused through his commanding officer.

The president of the court requests the commandant of the station, or the senior officer present to detail a suitable person to serve as provost marshal of the court. An officer of the Navy, not above the grade of lieutenant, or an officer of the Marine Corps not above the grade of captain is then detailed in compliance with this request.

In case of the trial of a petty officer or person of inferior rating of the Navy, or a non-commissioned officer, musician or private of marines, the provost marshal may be either a petty officer of the Navy or a non-commissioned officer of marines.

The provost marshal is responsible for the prisoner from the time he leaves his place of confinement until his return, except when he is actually before the court.

The president of the court sends the order for the prisoner to his immediate commanding officer by the provost marshal (Art. 1799).

It is the duty of the judge advocate to see that the accused has received a correct duplicate of the charges and specifications (Art. 1802); to furnish the accused with a list of witnesses to appear against him (Art. 1804); to summon all witnesses (Art. 1805); to see that a suitable place is provided for the sessions of the court, and that writing materials are supplied (Art. 1808).

The necessary guard and orderlies will be detailed by the captain of the ship, or commandant of the yard or station, on board of or at which the court is ordered to convene (Art. 1817). A request to this effect should be made by the president of the court.

Prior to the assembling of the court the judge advocate should notify the witnesses of the time and place of meeting, and should interview those for the prosecution to learn to what particulars they can testify. It is essential that the judge advocate should be thoroughly instructed as to all the circumstances of the case. This may be greatly facilitated by the convening authority forwarding to him the detailed statement of the cirsumstances (required by Art. 1033), on which the charges and specifications have been framed.

When the court assembles the president usually sits at the head of the table, and the judge advocate always sits opposite to him. The member second in rank sits to the right of the president, the next in rank to his left, and so on, to the right and left alternately, according to seniority.

The accused and his counsel sit a little to the right and rear of the judge advocate, and the witness to his left. The stenographer sits to his right; none of the parties should sit with their backs to the court. A small table should be provided for the accused and his counsel to write upon.

THE TRIAL.

The method of conducting the trial is clearly described in Art. 1818 of the "U. S. Navy Regulations," and the articles that follow.

In administering oaths, the custom of the service is for the officer administering, and the person taking the oath, to grasp a Bible with the right hand (hand ungloved), and for the former to recite the oath, after which the latter repeats the words "I do," (meaning that he so swears).

The president of a court is the only person authorized by law to administer oaths to witnesses before a general court-martial. Affidavits made before any other person cannot, therefore, be admitted as evidence. In case the president of the court is called upon to testify, the oath is administered by the member next in rank to the president.

(*Note.*—The Judge Advocate General has recommended that the "Regulations for the Government of the Navy" be so amended as to admit of the use of depositions before courts.)

If the court is cleared while a member is on the stand as a witness he does not withdraw, but resumes his seat as a member of the court. When the court is opened he resumes the witness stand.

When a general court-martial has finished a case and adjourned without date, if a new case is presented for trial the president specifies the date and hour when the court will meet, and notifies the members accordingly; this he may do through the judge advocate, or not, as he may see fit.

If, at the time set by the president of the court for the trial, the judge advocate has not prepared his case the latter may request a postponement, in the same manner as is allowed the accused.

The court must expressly acquit or convict the accused of each allegation that is contained in the specification (Art. 1850).

Questions should be numbered consecutively throughout the examination of a witness, and the record should show at each stage of the examination by whom it is conducted, *i. e.*, "By the Judge Advocate," "By the Accused," or "By the Court." Each page should be numbered on the right margin, about the middle, and the leaves of the record when completed are attached together at the top of the odd-numbered pages. They must, therefore, be filled in the reverse order, *i. e.*, by turning them over longitudinally and continuing from the top, thus making the record continuous and the paging consecutive. (See pages 8 and 14, "Naval Summary Courts-Martial," by Lieut. S. C. Lemly, U. S. N., and Lieut. F. L. Denny, U. S. M. C.)

An error in statement of the rank or relative position of any member of a general court-martial will not affect the validity of the order convening the court. Authority to correct such errors should be obtained from the convening authority.

The judge advocate may correct obvious errors of form, and mistakes in names, dates, amounts, etc. This, however, if done at all, would have to be done with great care, and the better plan, where there is any doubt, is to obtain the sanction of the convening authority, and a request for such permission should be in writing, and this, with the authority to make the correction, should be appended to the record.

Certain offenses that are charged (and of which the accused may be found not guilty), sometimes include a lesser offense of which he is guilty. The offense of desertion, for instance, includes the lesser offense of absence without leave. If the absence is established to the satisfaction of the court, and there is no proof of the intent to permanently abandon the service, it is the duty of the court to find proved so much of the specification as supports the charge of absence without leave, and that the accused is of the charge guilty in a less degree than charged; guilty of absence without leave, and then to award a sentence adequate to the offense. (See G. C. O., No. 96, Nov. 22, 1893.)

GENERAL COURT-MARTIAL.

FORM OF PROCEDURE.

Note.—When a general court-martial meets or adjourns, the commandant, or commanding officer, should be notified of the fact.

[BRIEF.]

1. Court meets.
2. Accused is introduced.
3. Does accused desire counsel?
4. Has the accused received a copy of the charges and specifications?
5. Read precept in presence of the accused.
6. Does the accused object to any member of the court present sitting on his trial?
7. Judge Advocate sworn by the President.
8. Court sworn by the Judge Advocate. Clerk, or stenographer, sworn by the Judge Advocate.
9. Court cleared to examine charges and specifications, and to consider preliminary matters pertaining to the trial.
10. Court opened; accused and Judge Advocate re-appear.
11. Is the accused ready for trial?
12. Charges and specifications read aloud in the presence of the accused.
13. Arraignment; accused called upon to plead:

1st. To the specifications of the first charge, in numerical order.

2d. To the first charge (then to the other specifications and charges).

Note I.—If the accused pleads guilty to any of the specifications or charges, the President warns him that he thereby precludes himself from the benefits of a regular defense to such specifications and charges.

Note II.—The interrogatories of the Judge Advocate, and the accused's answers, in arraignment should be given.

14. The prosecution begins.
15. First witness for prosecution sworn by President of court, and testifies.
16. Direct examination (by the Judge Advocate).
17. Cross examination (by the accused).
18. Re-direct examination (by the Judge Advocate).
19. Examination by the Court.
20. Testimony read aloud to witness for his correction; he then withdraws.

Note III.—The questions asked each witness should be numbered consecutively, beginning with No. 1.

21. The prosecution closes.
22. The defense begins.
23. Direct examination (by the accused).
24. Cross examination (by the Judge Advocate).
25. Re-direct examination (by the accused).
26. Examination by the Court.
27. Written defense.
28. Written reply of Judge Advocate.
29. The defense closes.
30. Trial finished.
31. Court cleared for deliberation (Judge Advocate retires).
32. Finding.
33. Sentence.
34. Judge Advocate called before Court and informed by President of finding and sentence.
35. Signing.
36. Adjournment.

The following oaths, or affirmations, shall be administered (see Articles 40 and 41 of "Articles for the Government of the United States Navy")—

1. By the President of the court to the Judge Advocate:

You, A. B., do swear (or affirm) that you will keep a true record of the evidence given to, and the proceedings of this court; that you will not divulge or by any means disclose the sentence of the court until it shall have been approved by the proper authority; and that you will not at any time divulge or disclose the vote or opinion of any particular member of the court unless required so to do before a court of justice in due course of law.

2. By the Judge Advocate to each member of the court:

You, A. B., do swear (or affirm) that you will truly try without prejudice or partiality, the case now depending, according to the evidence which shall come before the court, the rules for the government of the Navy, and your own conscience; that you will not by any means divulge or disclose the sentence of the court until it shall have been approved by the proper authority; and that you will not at any time divulge or disclose the vote or opinion of any particular member of the court, unless required so to do before a court of justice in due course of law.

3. By the President of the court to each witness:

You, A. B., do solemnly swear (or affirm) that the evidence you shall give in the case now before this court shall be the truth, the whole truth, and nothing but the truth, and that you will state everything within your knowledge in relation to the charges: so help you God; (or, this you do under the pains and penalties of perjury).

[TITLE PAGE.]

LEGS, JAMES,
SEAMAN,
U. S. NAVY.
NAVY YARD, NEW YORK,
June 9, 1894.

Proceedings of a General Court Martial, convened at the Navy Yard, New York, by order of the Secretary of the Navy.

Note.—The name, rate, ship (or other place of trial) and date of trial should be written as above, in the right hand corner, commencing on the second line.

The brief, as above, should be written in the center of the title page.

NAVY YARD, NEW YORK,
12.00 M., SATURDAY, *June* 9, 1894.

The court met, pursuant to an order, a certified copy of which is appended, marked "A".

1st Variation.—The court met, pursuant to adjournment of yesterday, and proceeded with the next case before it, that of James Legg, seaman, U. S. Navy.

2d Variation.—The court met, pursuant to an order, a certified copy of which is appended, marked "A", and proceeded with the next case before it, that of James Legs, seaman, U. S. Navy.

PRESENT.

Captain E. M. S., U. S. Navy,
Lieutenant Commander B. S. R., U. S. Navy,
Lieutenant D. D. S., U. S. Navy,
Lieutenant G. C. H., U. S. Navy,
Lieutenant W. C. B., U. S. Navy,
Lieutenant S. M., U. S. Navy,
Captain S. M., U. S. M. C., *members*, and
Lieutenant W. J. S., U. S. Navy, *Judge Advocate.*

3d Variation.—Absent, by reason of illness, Lieutenant D. D. S., U. S. Navy, a medical certificate of which is appended, marked "B".

The accused, James Legs, seaman, U. S. Navy, appeared, and, in answer to the inquiries of the Judge Advocate, stated that he did not desire counsel, and that he had received a copy of the charge(s) and specification(s) preferred against him.

4th Variation.—If the accused desires counsel:

The accused, James Legs, seaman, U. S. Navy, appeared, and having asked and received permission, introduced Lieutenant R. O. B., U. S. Navy, as his counsel.

The accused, in answer to the Judge Advocate, stated that he had received a copy of the charge(s) and specification(s) preferred against him.

The Judge Advocate then read aloud, in the presence and hearing of the accused, the order convening the court, a certified copy of which is appended, marked "A".

5th Variation.—The Judge Advocate then read aloud, in the presence and hearing of the accused, the order convening the court, a copy of a telegram from the Acting Secretary of the Navy, authorizing a change in the precept of Captain S. C. M., U. S. Marine Corps, to Captain S. M., U. S. Marine Corps, and an order from the Secretary of the Navy, appointing Lieutenant W. J. S., U. S. Navy, Judge Advocate of the Court in place of First Lieutenant E. R. L., U. S. Marine Corps; certified copies of which are appended, marked "A," "C" and "D," respectively.

The accused was asked by the Judge Advocate if he objected to being tried by any member present, to which he replied in the negative.

6th Variation.—To which he submitted the following objections. (Here insert the objections of the accused.)

The challenged member then stated (here insert member's statement).

The court was cleared, and the Judge Advocate, the challenged member, (and) the accused, (and counsel) retired.

After due deliberation, the court was opened, the Judge Advocate, the challenged member, (and) the accused, (and counsel) resumed their seats, and the decision of the court was announced, that the objection of the accused was sustained.

The challenged member, Lieutenant W. C. B., U. S. N., then withdrew.

Or, . . was announced, that the objection of the accused was overruled.

Note.—It is the practice for a challenged member to retire, as indicated in the preceding; but it is not obligatory on the part of the challenged member to withdraw. If he remain in court, however, he should refrain from taking any part in the proceedings.

The Judge Advocate was then duly sworn by the President of the court, and each of the members of the court was duly sworn by the Judge Advocate, all of which oaths were administered according to law, and in the presence of the accused.

The court was then cleared for the examination of the charge(s) and specification(s), and the consideration of all matters preliminary to trial, and, after deciding upon these, was opened, and the Judge Advocate, (and) the accused (and counsel) reappeared.

7th Variation.—If any objections to the charge(s) and specification(s) are made, they must be regularly and fully recorded here. (See Art. 1826, Navy Regulations.)

The accused, in answer to the inquiry of the Judge Advocate, stated that he was ready for trial.

The Judge Advocate then read aloud, in the presence and hearing of the accused, the charge(s) and specification(s) preferred against him, the original of which is appended, marked "E".

To which charge(s) and specification(s) the accused, James Legs, seamen, U. S. N., being called upon to plead, pleaded as follows:

8th Variation.—(A case involving one charge and one specification, to which the accused pleads guilty, will be first given.)

By the Judge Advocate:

James Legs, seaman, United States Navy, you have heard the charge, and specification of the charge, preferred against you by the Secretary of the Navy, just read. What say you to the specification of the charge; guilty, or not guilty?

Plea by the accused:

"Guilty."

By the Judge Advocate:

And what say you to the charge; guilty, or not guilty?

Plea by the accused:

"Guilty."

The President of the court then warned the accused that in pleading guilty he thereby precluded himself from the benefits of a regular defense.

The accused persisted in his plea, and no evidence was therefore taken by the prosecution.

The prosecution closed here.

The defense began here.

The accused desired to call witnesses to character.

Lieutenant W. H. E., U. S. N., a witness to character, for the accused, was duly sworn, according to law, by the President of the court, in the presence of the accused, and testified as follows:

DIRECT EXAMINATION.

By the accused:

1. Question.

What is your name, rank, and present duty?

Answer.

W. H. E., Lieutenant, U. S. N., serving on board the U. S. R. S. Minnesota, at New York.

2. Question.

Do you recognize me, and if so, as whom?

Answer.

I do, as James Legs, seaman, U. S. N.

3. Question.

Answer.

Note.—Witnesses to character may be cross-examined by the Judge Advocate. (See Art. 1827, Par. 2, U. S. N. Regulations.)

CROSS-EXAMINATION BY THE JUDGE ADVOCATE.

4. Question.

You have stated that the character of the accused is excellent; please give your reasons for this statement?

Answer.....

There being no further questions to ask this witness, his testimony was read aloud, and pronounced by him to be correct; he then withdrew, after being cautioned by the President of the court not to converse upon matters pertaining to the trial.

The accused desired to submit a written statement to the court, which, by request of the accused, and permission of the court, was read aloud by the Judge Advocate, and appended to the record, marked "F".

The defense closed here.

The trial was finished.

The court was then cleared, and the Judge Advocate withdrew. After full and mature deliberation by the court, the Judge Advocate was called before it and informed by the President that the court finds the specification proved by plea, and the accused, James Legs, seaman, U. S. Navy, of the charge guilty; and the court does therefore sentence him, the said James Legs, seaman, U. S. Navy, to the following punishment, viz.: To be confined in such place as the Secretary of the Navy may designate for the period of eighteen (18) months; to lose all pay that may become due him during his term of confinement except the sum of three dollars ($3.00) per month for necessary prison expenses, and a further sum of twenty-five dollars ($25.00) to be paid to him at the expiration of his term of confinement; total loss of pay amounting to three hundred and seventy-eight dollars ($378.00); then to be dishonorably discharged from the U. S. Naval Service.

E. M. S., *Captain, U. S. Navy.*
B. S. R., *Lieutenant-Commander, U S. Navy.*
D. D. S., *Lieutenant, U. S. Navy.*
G. C. H., *Lieutenant, U. S. Navy.*
W. C. B., *Lieutenant, U. S. Navy.*
H. M., *Lieutenant, U. S. Navy.*
S. M., *Captain, U. S. Marine Corps.*
W. J. S., *Lieutenant, U. S. Navy, Judge Advocate.*

In view of . . . , we, the undersigned members of the court, respectpectfully recommend the accused to the clemency of the revising authority.

E. M. S., *Captain, U. S. Navy.*
D. D. S., *Lieutenant, U. S. Navy.*
H. M., *Lieutenant, U. S. Navy.*
S. M., *Captain, U. S. Marine Corps.*

The court having no further case before it, then, at 2.30 P. M., adjourned to await the action of the convening authority.

E. M. S., *Captain, U. S. N.*
W. J. S., *Lieutenant, U. S. N. Judge Advocate.*

Variation.— . . . having finished the trial of James Legs, seaman, U. S. N., then, at 2.30 P. M., adjourned to meet on Monday, June 11, 1894, at 10 A. M. (or took a recess until 3 P. M.), when it will proceed with the case of Charles Noble, seaman, U. S. N. (or took up the case of Charles Noble, seaman, U. S. N.).

(A case will now be given involving two, or more charges and several specifications.)

By the Judge Advocate:

James Legs, seaman, United States Navy, you have heard the charges, and specifications of the charges preferred against you by the Secretary of the Navy, just read. What say you to the first specification of the first charge; guilty, or not guilty?

Plea by the accused:

"Not guilty."

By the Judge Advocate:

And what say you to the second specification of the first charge; guilty, or not guilty?

Plea by the accused:

"Not guilty."

By the Judge Advocate:

And what say you to the first charge; guilty, or not guilty?

Plea by the accused:

"Not guilty."

By the Judge Advocate:

What say you to the first specification of the second charge; guilty, or not guilty?

Plea by the accused:

"Guilty."

By the Judge Advocate:

And what say you to the second specification of the second charge; guilty, or not guilty?

Plea by the accused:

"Not guilty."

By the Judge Advocate:

And what say you to the second charge; guilty, or not guilty?

Plea by the accused:

"Not guilty."

The President of the court then warned the accused that in pleading guilty to the first specification of the second charge he thereby precluded himself from the benefits of a regular defense to that specification.

The accused persisted in his plea, and no evidence was therefore taken by the prosecution to prove that specification.

The prosecution began here. Lieutenant J. L. P., U. S. N., a witness for the prosecution, was duly sworn, according to law, by the President of the court, in the presence of the accused, and testified as follows:

DIRECT EXAMINATION.

By the Judge Advocate:

1. Question.

What is your name, rank, and present duty?

Answer.

J. L. P., Lieutenant, U. S. N., serving on board the U. S. S. Essex.

2. Question.

Do you recognize the accused, and if so, as whom?

Answer.

I do, as James Legs, seaman, U. S. N.

3. Question.....

Answer.....

CROSS EXAMINATION.

By the counsel for the accused:

10. Question.

Have you ever served on the European station?

The Judge Advocate objected to this question on the ground that it was irrelevant.

In reply, the counsel for the accused stated that.....

The court was cleared, and the Judge Advocate, the accused and his counsel retired.

After due deliberation, the court was opened, the Judge Advocate, the accused and his counsel resumed their seats, and the decision of the court was announced, that the objection of the Judge Advocate was sustained.

Or.....was announced, that the objection of the Judge Advocate was overruled. (In the latter case record as follows:)

Answer.

I have.

11. Question.....

Answer.....

RE-DIRECT EXAMINATION.

By the Judge Advocate:
15. Question.....
Answer.....

EXAMINATION BY THE COURT.

25. Question.....
Answer.....

There being no further questions to ask this witness, his testimony was read aloud and pronounced by him to be correct; he then withdrew (after being cautioned by the President of the court not to converse upon matters pertaining to the trial).

The prosecution closed here.

The defense began here.

Lieutenant H. S. C., U. S. Navy, a witness for the defense, was duly sworn according to law, by the President of the court, in the presence of the accused, and testified as follows:

DIRECT EXAMINATION.

By the counsel for the accused:
1. Question.....
Answer.....

CROSS-EXAMINATION.

By the Judge Advocate:
8. Question.....
Answer.....

RE-DIRECT EXAMINATION.

By the accused:
12. Question.....
Answer.....

EXAMINATION BY THE COURT.

16. Question.....
Answer.....

There being no further questions to ask this witness, his testimony was read aloud, and pronounced by him to be correct; he then withdrew.

(If the accused testifies):

The accused, James Legs, seaman, U. S. Navy, at his own request, was then allowed to tesify in his own behalf, and, upon being duly sworn, according to law, by the President of the court, testified as follows:

The accused did not desire to call any further witnesses for defense (but submitted a written statement, which he read aloud, and is appended to to the record, marked "F").

The Judge Advocate read aloud a written reply, which is appended, marked "G," or,

The Judge Advocate submitted the case to the court without remark.

The defense closed here.

The trial was finished.

The court was then cleared, and the Judge Advocate withdrew. After full and mature deliberation by the court, the Judge Advocate was called before it and informed by the President that the court finds the first and second specifications of the first charge proved, and the accused, James Legs, seaman, U. S. Navy, of the first charge guilty; the first specification of the second charge proved by plea; the second specification of the second charge proved in part; proved, except the words "first day of March," which words are not proved, and the court substitutes for the excepted words, the words "tenth day of March," which words are proved, and the accused, James Legs, seaman, U. S. Navy, of the second charge guilty in a less degree than charged; guilty of absence without leave; and the court does therefore sentence him, the said James Legs, seaman, U. S. Navy, to the following punishment, viz.; To be confined, etc., (as in the first case given).

Note.—In case any specification or charge is found not proved, the court should specifically acquit the accused upon such specification or charge.

For reviewal of proceedings, and final action of the revising authority, see U. S. N. Regulations, Art. 1867–1876, and "Naval Summary Courts-Martial," pages 26–28.

The following should be appended to the record of a general court-martial:

The precept, or a certified copy of it.

The charges and specifications.

The original letter transmitting the charges and specifications to the Judge Advocate.

The original or certified copies of letters from the convening authority to the President of the court, notifying the latter of any change in the precept; such, for instance, as officers being detached from or added to the court.

Original or certified copies of written matter introduced as evidence.

Original or certified copies of orders authorizing changes in the precept.

Original orders authorizing a change in the charges or specifications.

Written defense, or statement, of the accused to the court.

Written reply of the Judge Advocate.

[FORMS.]

U. S. R. S. VERMONT,
NAVY YARD, NEW YORK, *May* 25, 1894.

Sir:—I respectfully recommend that James Legs, seaman, U. S. N., may be brought to trial before a General Court-Martial for the following offenses committed while serving on board this vessel.

1st. On, or about, May 15, 1894, (here give first offense).
2d. On, or about, May 18, 1894, (here give second offense).
3d. On, or about, May 20, 1894, (here give third offense).

Very respectfully,
H. B. M., *Commander, U. S. N., Commanding.*

TO THE COMMANDANT,
Navy Yard and Station, New York, N. Y.

[FORM OF CHARGE AND SPECIFICATION.]

Charge and specification of a charge preferred by the Secretary of the Navy against James Legs, seaman, alias Charles Noble, seaman, in the U. S. Navy.

CHARGE.

Conduct to the prejudice of good order and discipline, in violation of Article Twenty-two of the Articles for the Government of the Navy.

SPECIFICATION.

In that the said James Leg, alias Charles Noble, a seaman in the U. S. Navy, attached to and serving on board the United States receiving ship Vermont, at the Navy Yard, New York, did, on the twenty-fifth day of October, eighteen hundred and ninety-three, on board said ship, procure himself to be accepted and did fraudulently enlist as a seaman in the United States Navy, by falsely representing that he had no previous naval service, and by deliberately and wilfully concealing from the recruiting officer the fact that he was, on the fourteenth day of April, eighteen hundred and ninety-three, dishonorably discharged from the United States Navy, under the name of James Legs, seaman, pursuant to the sentence of a general court-martial; and furthermore, that he, the said Legs, alias Noble, has, on board said receiving ship Vermont, since said enlistment, received pay and and allowances thereunder.

H. A H., *Secretary of the Navy.*

Navy Department, *June* 1, 1894.

[LETTER OF TRANSMITTAL.]

NAVY DEPARTMENT,
WASHINGTON, *June* 1, 1894.

Sir:—I transmit herewith charge with specification, against James Legs, seaman, U. S. Navy, alias Charles Noble, seaman, U. S. Navy, who will be tried before the general court-martial, of which you are Judge Advocate, ordered to convene at the Navy Yard, New York, on Saturday, the 9th instant.

You will summon such witnesses as may be required for his defense.

Very respectfully, H. A. H., *Secretary of the Navy.*

LIEUTENANT W. J. S., U. S. NAVY,
U. S. R. S. Minnesota, New York, N. Y.

[PRECEPT.]

NAVY DEPARTMENT,
WASHINGTON, *June* 1, 1894.

To Captain E. M. S., U. S. Navy, U. S. R. S. Minnesota, New York, N. Y.

A general court-martial is hereby ordered to convene at the Navy Yard, New York, at noon, on Saturday, the 9th day of June, 1894, or as soon thereafter as practicable, for the trial of James Legs, seaman, U. S. Navy, alias Charles Noble, seaman, U. S. Navy, and of such other persons as may be legally brought before it.

The court is composed of the following members, any five of whom are empowered to act, viz:

Lieutenant-Commander B. S. R., U. S. Navy,
Lieutenant D. D. S., U. S. Navy,
Lieutenant G. C. H., U. S. Navy,
Lieutenant W. C. B., U. S. Navy,
Lieutenant H. M., U. S. Navy,
Captain S. M., U. S. Marine Corps,

and of Lieutenant W. J. S., U. S. Navy, as Judge Advocate. No other officers can be detailed without manifest injury to the service.

This employment on shore duty is required by the public interests.

H. A. H., *Secretary of the Navy.*

[ORDER TO PRESIDENT.]

BUREAU OF NAVIGATION, NAVY DEPARTMENT,
WASHINGTON, *June* 1, 1894.

Sir:—The Secretary of the Navy having appointed you President of a General Court-Martial, ordered to convene at the Navy Yard, New York, at noon, an Saturday, the 9th day of June, 1894, you will report to the Commandant on the date specified.

The members of the Court and the Judge Advocate have been directed to report to you.

This duty is in addition to your present duties.

Respectfully, F. M. R., *Chief of Bureau.*

CAPTAIN E. M. S., U. S. NAVY,
U. S. R. S. Minnesota, New York, N. Y.

[ORDER TO JUDGE ADVOCATE, OR MEMBER.]

BUREAU OF NAVIGATION, NAVY DEPARTMENT,
WASHINGTON, *June* 1, 1894.

Sir:—The Secretary of the Navy having appointed you Judge Advocate (or a member), of a General Court-Martial, ordered to convene at the Navy Yard, New York, at noon, on Saturday, the 9th day of June, 1894, you will report to Captain E. M. S., U. S. N., the presiding officer of the Court, at the place and time specified.

This duty is in addition to your present duties.

Respectfully, F. M. R., *Chief of Bureau.*

LIEUTENANT W. J. S., U. S. NAVY,
U. S. R. S. Minnesota, New York, N. Y.

[SUBPŒNA.]

U. S. R. S. MINNESOTA,
NEW YORK, *June* 5, 1894.

Sir:—You are hereby summoned to appear before a General Court-Martial which will convene at the Navy Yard, New York, on Saturday, June 9, 1894, at noon, to testify in the case of James Legs, seaman, U. S. Navy.

Very respectfully,
W. J. S., *Lieutenant U. S. Navy, Judge Advocate.*

TO LIEUTENANT G. R. C., U. S. NAVY,
U. S. S. Essex, Navy Yard, New York.

[REQUEST THAT PROVOST MARSHAL, GUARD AND ORDERLIES MAY BE DETAILED.]

U. S. R. S. MINNESOTA,
NEW YORK, *June* 5, 1894.

Sir:—Having been appointed President of a General Court-Martial which will covene at the Navy Yard, New York, on Saturday, June 9, 1894, at noon, I respectfully request that a suitable person may be detailed to serve as Provost Marshal, and that the necessary guard and orderlies may be detailed, as provided in Articles 1799 and 1817 of the U. S. Navy Regulations.

Very respectfully,
E. M. S., *Captain U. S. Navy, President of the Court.*

TO THE COMMANDANT,
Navy Yard and Station, New York, N. Y.

[REQUEST THAT A ROOM BE PROVIDED.]

U. S. R. S. MINNESOTA,
NEW YORK, *June* 5, 1894.

Sir:—Having been appointed Judge Advocate of a General Court-Martial which will convene at the Navy Yard, New York, on Saturday, June 9th, at noon, I respectfully request that a room may be provided for the sessions of the court, as required by Article 1808 of the U. S. Navy Regulations.

Very respectfully,
W. J. S., *Lieutenant U. S. Navy, Judge Advocate.*

TO THE COMMANDANT,
Navy Yard and Station, New York, N. Y.

[LETTER TRANSMITTING RECORD.]

NAVY YARD, NEW YORK,
June 11, 1894.

Sir:—I transmit herewith the record of the proceedings of the General Court-Martial, of which I am President, in the case of James Legs, seaman, U. S. Navy.

Very respectfully,
E. M. S., *Captain U. S. Navy, President of the Court.*

TO THE JUDGE ADVOCATE GENERAL,
Navy Department, Washington, D. C.

[LETTER TO CONVENING AUTHORITY.]

NAVY YARD, NEW YORK,
June 11, 1894.

Sir:—In accordance with Article 1866, of the U. S. Navy Regulations, I have the honor to inform you that all business before the General Court-Martial, of which I am President, has been completed.

Very respectfully,
E. M. S., *Captain U. S. Navy, President of the Court.*

TO THE SECRETARY OF THE NAVY,
Navy Department, Washington, D. C.

PROFESSIONAL NOTES.

RELATIONS BETWEEN THE BAROMETRIC PRESSURE AND THE STRENGTH AND DIRECTION OF OCEAN CURRENTS.

By LIEUT. W. H. BEEHLER, U. S. N.

[*Extract from the papers of the Chicago Meteorological Congress, August, 1893.*]

The effect of the barometric pressure on the Gulf Stream has been well established, and in Lieut. Pillsbury's report on the "Gulf Stream Investigations and Results," there is one chapter devoted to the cause of the Gulf Stream and of Atlantic Currents. After a very thorough examination of the gravity and wind theories, he advocates the wind theory as the principal cause, but in the closing pages of the chapter he explains abnormal currents by the effect of barometric pressure. He states that a difference of one inch in the barometric column, or about half a pound in atmospheric pressure, will give over one foot difference in the elevation of the surface of the sea.

The chart of isobars for the year shows that there is a region in the North Atlantic between about N. 10° and N. 40° of about 9,600,000 square miles where the barometric pressure is above the normal, 29.92 inches (760 mm.). North of this zone there is an area of ocean surface of about 2,300,000 square miles where the pressure is below the normal.

The maximum high is about 30.16 inches and the minimum low is 29.69 inches, or a difference of about 0.47 of an inch. If one inch in the height of the barometer represents about half a pound in the atmospheric pressure per square inch, the total difference of the weight of atmosphere upon these regions reaches an enormous figure, sufficient to cause a very decided difference between the levels of the sea at the areas of the maximum high and minimum low. (This difference, I believe, amounts to about 20 meters.) The surface water will be forced up an incline in the region of the "low." The lack of pressure, or rather the diminished air pressure in the low region, taken in connection with the lesser area, will still farther enhance the accumulation of the water in the region of the "low."

The atmospheric pressure in the Atlantic causes the accumulation in the western part of the Caribbean Sea, and the sea level there and in the Gulf of Mexico is one meter higher than that off Sandy Hook, N. Y.

The Gulf Stream, thus formed, unites with the waters of the Atlantic circulating around the "high" and flowing up along the Bahamas, and following the United States coast line to Hatteras. The waters continue on, but after passing the Grand Banks they meet with no further coast resistance and are pushed out by the barometric pressure, which is constantly diminishing, into the Arctic until the upward slope is so great that the diminishing pressure can no longer force the water there. A large volume of water flows down between the Azores and the coasts of Portugal and Africa, where the pressure is less than the maximum, and then continues circulating around as before.

The water thus continually pressed away by the high pressure from the mid North Atlantic must be replaced, and consequently there are undercurrents of cold water from the Arctic and northern part of the North Atlantic to restore the equilibrium. These cold currents will, on account of their specific gravi-

[REQUEST THAT A ROOM BE PROVIDED.]

U. S. R. S. MINNESOTA,
NEW YORK, *June* 5, 1894.

Sir:—Having been appointed Judge Advocate of a General Court-Martial which will convene at the Navy Yard, New York, on Saturday, June 9th, at noon, I respectfully request that a room may be provided for the sessions of the court, as required by Article 1808 of the U. S. Navy Regulations.

Very respectfully,
W. J. S., *Lieutenant U. S. Navy, Judge Advocate.*

TO THE COMMANDANT,
Navy Yard and Station, New York, N. Y.

[LETTER TRANSMITTING RECORD.]

NAVY YARD, NEW YORK,
June 11, 1894.

Sir:—I transmit herewith the record of the proceedings of the General Court-Martial, of which I am President, in the case of James Legs, seaman, U. S. Navy.

Very respectfully,
E. M. S., *Captain U. S. Navy, President of the Court.*

TO THE JUDGE ADVOCATE GENERAL,
Navy Department, Washington, D. C.

[LETTER TO CONVENING AUTHORITY.]

NAVY YARD, NEW YORK,
June 11, 1894.

Sir:—In accordance with Article 1866, of the U. S. Navy Regulations, I have the honor to inform you that all business before the General Court-Martial, of which I am President, has been completed.

Very respectfully,
E. M. S., *Captain U. S. Navy, President of the Court.*

TO THE SECRETARY OF THE NAVY,
Navy Department, Washington, D. C.

PROFESSIONAL NOTES.

RELATIONS BETWEEN THE BAROMETRIC PRESSURE AND THE STRENGTH AND DIRECTION OF OCEAN CURRENTS.

By Lieut. W. H. Beehler, U. S. N.

[*Extract from the papers of the Chicago Meteorological Congress, August, 1893.*]

The effect of the barometric pressure on the Gulf Stream has been well established, and in Lieut. Pillsbury's report on the "Gulf Stream Investigations and Results," there is one chapter devoted to the cause of the Gulf Stream and of Atlantic Currents. After a very thorough examination of the gravity and wind theories, he advocates the wind theory as the principal cause, but in the closing pages of the chapter he explains abnormal currents by the effect of barometric pressure. He states that a difference of one inch in the barometric column, or about half a pound in atmospheric pressure, will give over one foot difference in the elevation of the surface of the sea.

The chart of isobars for the year shows that there is a region in the North Atlantic between about N. 10° and N. 40° of about 9,600,000 square miles where the barometric pressure is above the normal, 29.92 inches (760 mm.). North of this zone there is an area of ocean surface of about 2,300,000 square miles where the pressure is below the normal.

The maximum high is about 30.16 inches and the minimum low is 29.69 inches, or a difference of about 0.47 of an inch. If one inch in the height of the barometer represents about half a pound in the atmospheric pressure per square inch, the total difference of the weight of atmosphere upon these regions reaches an enormous figure, sufficient to cause a very decided difference between the levels of the sea at the areas of the maximum high and minimum low. (This difference, I believe, amounts to about 20 meters.) The surface water will be forced up an incline in the region of the "low." The lack of pressure, or rather the diminished air pressure in the low region, taken in connection with the lesser area, will still farther enhance the accumulation of the water in the region of the "low."

The atmospheric pressure in the Atlantic causes the accumulation in the western part of the Caribbean Sea, and the sea level there and in the Gulf of Mexico is one meter higher than that off Sandy Hook, N. Y.

The Gulf Stream, thus formed, unites with the waters of the Atlantic circulating around the "high" and flowing up along the Bahamas, and following the United States coast line to Hatteras. The waters continue on, but after passing the Grand Banks they meet with no further coast resistance and are pushed out by the barometric pressure, which is constantly diminishing, into the Arctic until the upward slope is so great that the diminishing pressure can no longer force the water there. A large volume of water flows down between the Azores and the coasts of Portugal and Africa, where the pressure is less than the maximum, and then continues circulating around as before.

The water thus continually pressed away by the high pressure from the mid North Atlantic must be replaced, and consequently there are undercurrents of cold water from the Arctic and northern part of the North Atlantic to restore the equilibrium. These cold currents will, on account of their specific gravi-

ties, fall below the warmer surface currents, and while this barometric pressure is acting, these cold currents flowing south cannot appear on the surface, for if they did appear they would, under normal conditions, be necessarily brushed back again toward the Arctic.

Where the configuration of the coast has deflected this circulation of water away from the shores, the cooler currents may there appear on the surface, and, consequently, we find a cold current from the Arctic along the coast of Labrador, sneaking in around Newfoundland and close along the United States coast to Hatteras and Florida.

In the Report for 1891, Appendix No. 10, of the U. S. Coast and Geodetic Survey, Prof. E. E. Haskell publishes an account of observations of currents in the Straits of Florida and Gulf of Mexico, and on page 347 he states:

"Over a water surface unequal atmospheric pressure and wind both become causes, acting generally at an angle with each other to produce a current. The former is the equivalent of a head to be spent as a gravity force in the direction of the trend of the barometric gradient, while the latter acts by friction on the surface to produce a current in its direction. There is little or no information extant as to the current that any known velocity of wind and barometric gradient will produce, nor is there a definite enough relation between direction of wind and trend of barometic gradient to permit of making more than the general statement that the current should be in the direction of the resultant of the two forces."

I quote this by permission, and this pamphlet contains tables connecting the observations of currents with meteorological data. I also have in a letter from Prof. Haskell the further statement that, "If I had at my command daily observations of the direction and force of the wind and the reading of the barometer from stations so located as to surround the Gulf, I could predict the currents much as our weather is predicted."

In investigating the ocean currents it must be remembered that the mountain of air in the region of the almost permanent "high" is not constant in extent or in exact locality. I have taken the average annual location and direction of the areas of the "high" in the North Atlantic. This varies, and the Pilot Chart for each month shows these variations graphically. Again, near the belt of normal atmospheric pressure the air circulation around the "high" is accompanied by other circulations, both cyclonic and anticyclonic, and these storms will temporarily disturb the normal condition and cause variations in the current both in strength and direction.

RUSTLESS COATINGS FOR IRON.

[*Journal of the Society of Arts.*]

The following is a translation of Mr. Frederick W. North of a paper read before the Paris Société d'Encouragement by M. Octave de Rochefort-Lucay, on the new Bertrand processes for coating with magnetic oxide and enameling iron and iron carburets, and on a new process of tinning for cast iron.

Messrs. Barff and Bower were the first to practically coat iron, steel and cast iron with magnetic oxide, so as to form, at the cost of the metal itself, the protective layer that is obtained usually from paint, or from enameling, etc., with a thin coating of a metal that is not oxidizable.

The Bertrand processes are more simple than those of Bower and Barff, and are based on a new discovery in chemistry, and may be stated thus: If a thin adherent film of another metal is formed on the wrought iron or on the cast iron, and this iron or cast iron, heated to 1000°, is exposed to a current of oxidizing gas, the oxygen penetrates through the film, oxidizes the iron or the cast iron, and under these conditions, magnetic oxide is the result. The formation of magnetic oxide, thus obtained, continues indefinitely, and the thickness

of the coating of oxide increases according to the period of exposure to the oxidizing current, providing the temperature remains at about 1000°.

As to the film of metal deposited in the first instance, it disappears in some obscure way, forming oxides which mingle with the magnetic oxide or volatilize according to the nature of the metal of which they are composed. M. Bertrand had then to find the best metal and the best method for depositing it on the article to be coated, and he has found that bronze, a mixture of copper and tin, gives from a practical point of view every satisfaction. For depositing this bronze on the wrought iron and cast iron, M. Bertrand uses electricity or wet baths, and uses sulphophenolic acid.

The following is the method adopted in the Bertrand manufactory for an oxidation: The article is cleansed (the cleansing is not indispensable), then dipped a few moments in a bath containing a solution of sulphophenate of copper and tin. The coating of bronze being formed, the article is immediately washed with cold water and dried with sawdust. The article dried is put into a furnace. Oxide forms, and at the end of fifteen to thirty minutes (according to the articles), the articles are taken out, sufficiently oxidized. The coating produced varies from 1-10 to 1-5 of a millimeter.

M. Bertrand uses electricity to ascertain if the coating is of sufficient and uniform thickness, and in doing so he makes use of bells. If in putting the two wires in contact with the oxidized article the bells ring, the current passes—the oxidation is insufficient; if it remains silent, the oxide formed is of sufficient practical thickness because it prevents the electric current from passing.

Process for Tinning Cast Iron.—M. Bertrand has also used sulphophenolic acid to obtain tinning on iron. He dissolves salts of tin in a mixture of water and sulphophenolic acid at the rate of one per cent. of tin salt, and five per cent. of sulphophenolic acid. In this mixture the article, which is previously cleaned, is dipped, and is at once covered with an adherent coating of tin, and afterward by the means of rotating brushes in wire and cloth, the coating of tin is polished, and a result obtained which is both effective and cheap.

Process for Enameling.—There are not more than two processes for enameling cast iron. In the first, called hot, the iron, heated to a vivid red, is powdered with a flux powder (borosilicate of lead), distributed with a sieve, then it is heated, and when the flux fuses it is powdered afresh with glass more soluble, forming the glaze of the enamel. This process, the only direct enameling, is dangerous to the operator, and even impossible for large articles, nor does it allow of decorations. The second process consists of dressing the cast iron either by three distinct and successive operations in the furnace with a kind of pottery. In the Bertrand enameling, the article is first coated with magnetic oxide, then dipped in borosilicates of lead, colored by metallic oxides, in which is added a little pipe clay in order to give rather more body. The article thus covered cold, by dipping or with brushes, is put into the furnace; the enamel adheres and vitrifies at the usual furnace temperatures used by enamelers. By putting a coating of colored enamel with a brush on a first coat simply plain, it is possible to make any decorations desired, which may be burnt in at one operation for outdoor vases, etc. These results, due to the first oxidation, with magnetic oxide, are remarkable, as much for the color as for the tenacity of the enamel and its resistance to rough usage.

TESTING THE MAGNETIC QUALITIES OF IRON.

The construction of dynamos and transformers has attained such large dimensions that it has become an object of solicitude to iron manufacturers and merchants to obtain the orders for the material used in building them. Very great difficulty has, however, been experienced in fulfilling the demand of the electricians, as the subject is comparatively new, and it is not clearly

understood what are the factors that influence the magnetic permeability of iron. Formerly it was customary to specify that electro-magnets should be made from the best Swedish iron, and satisfactory results were so obtained; but when the weights run to tons the cost of such iron becomes prohibitory, and a cheaper variety of material has to be found. The trouble that is experienced in getting suitable iron for electro-magnets is much increased when the material is required for the cores of transformers. In these the polarity is reversed some 200 times per second, and at each change energy is absorbed by histeresis. One lot of iron may turn out very well, while the next, from the same manufacturer, made in the same way, from similar materials, will prove most disappointing. It is, therefore, very desirable to have an easy method of testing iron, so that its properties may be fully investigated before the design of the machine, for which it is intended, is completed, and also before any labor has been expended in shaping it. Two instruments for this purpose were described to the Institution of Electrical Engineers on the 22nd ult. by Mr. Gisbert Knapp, and were received with favorable comment by the audience. The first was for measuring the permeability of samples of iron and mild steel intended for electro-magnets, and the second for measuring the losses in iron designed for apparatus employing alternating currents.

The testing machine for iron bars is exceedingly simple. It consists of a solenoid mounted vertically in a rectangular frame of best Lowmoor iron, well annealed. This solenoid has its winding divided into sections, and connected to several terminals, so that a variable, but known, number of turns can be placed in circuit by using the various terminals. A reversing switch is inserted to facilitate the investigation of the complete cycle. When a current is passed through this coil the frame is magnetized, the upper crossbar being converted into a (say) north pole and the lower bar into a (say) south pole. In fact, it may be compared to a horseshoe magnet set vertically, with the keeper permanently attached to form the lower bar. But instead of having a coil on each leg, there is a single coil between, and parallel to, both legs. The sample of iron to be tested is about 13 in. long, and is turned accurately to ½ in. in diameter, except at one end, where there is an enlarged portion, and also a shoulder to resist the end pulled. This test-piece is passed through the coil, and is accurately centred at each end, so that its lower end, which is carefully faced, stands square in the instrument. Below the end of the test-piece, and coaxial with it, is a wrought iron plunger, so mounted in an easy-fitting hole in the frame that it has about half an inch of end play. At the lower end of this plunger can be attached a pan into which weights can be placed as desired.

When the test-piece is put in place and the current is turned on, a more permeable path is opened for the lines of force, which find an easier way through the rod than through the surrounding space, and immediately the plunger flies up and attaches itself to the end of the sample. Weights are then placed in the scale pan until the connection is broken. By gradually increasing the current and noting the weights required at each step, a curve can be constructed in which the abscissæ represent magnetizing forces, and the ordinates induction. The exact point at which the weight overcomes the magnetic attraction is best determined by slightly varying the current by means of a rheostat, the current itself being derived from a secondary battery, and not from a dynamo, as the latter is too irregular for reliable observations. The dimensions of the plunger and the hole in the frame being accurately measured, it is quite easy to determine by calculation how much of the ampére turns provided is required to overcome the resistance of the annular air space around the plunger. This is the only important correction required. The other corrections, such as the magnetic resistance of the frame, or that of the joint between the sample and the frame at the top, are quite trifling. Even the correction for the resistance of the air space is only important for low inductions. For inductions above 10,000 lines per square centimeter it becomes relatively small, and above 15,000 it is quite negligible.

The machine for testing transformer plates does not aim at measuring the magnetic permeability, as in the device just described. In place of this it measures the power lost in the sample by hysteresis, in the changes of the position of the molecules at each reversal of the magnetism, and by Foucault currents. An alternating current is sent through the coil and a wattmeter is arranged in the circuit; by means of this instrument the power which disappears can be calculated, and can be expressed in watts per pound of iron. In the discussion Mr. W. M. Mordey mentioned that the Brush Electric Engineering Company stipulated in their specifications that the loss should not exceed .38 watt per pound. The instrument consists essentially of a closed magnetic circuit of rectangular shape, the two longer limbs being enclosed in existing coils. One long limb and the two uprights are composed of plates in one piece; the other limb is formed by sample plates, which are laid together to make up a certain weight, and are then bound together with tape and inserted through the top coil. The sample is fixed with wooden wedges. The instrument is calibrated once for all by making a sample bar of the same quality of plate as the other part of the magnetic circuit, measuring the loss of power at different inductions, and apportioning the loss between the yoke and sample according to their weights. When testing other samples the total loss is measured by the wattmeter, and from this is deducted that portion of the loss which is occasioned by the iron which forms part of the instrument, the remainder being the loss in the sample. There is a small correction for the loss of power resulting from the ohmic resistance of the two coils. The induction is found from the electromotive force applied to the coils, and the frequency. The coils are subdivided with suitable terminals.

ENGLAND.

THE HAVOCK.

The torpedo-boat destroyer Havock is 180 ft. long by 18 ft. 6 in. beam; is a single-deck vessel, in form greatly resembling the first-class sea-going torpedo-boats built by Messrs. Yarrow & Co., the constructors of the craft we are describing. Forward there is a long turtle deck, well elevated above the water-line, which covers in a lofty forcastle, in which the larger number of the crew are berthed. At the after end of this turtle deck is the usual conning tower with steering wheel. The next compartment is filled up with berths, and abaft a separate compartment is devoted to the cook, and contains also fresh-water tanks and two more berths. From the galley to the engine-room are the two boiler compartments, containing each a locomotive boiler with copper firebox, working up to 180 lbs. per square inch, and capable of generating steam sufficient for the development of 1800 horse-power. The engine-room contains two sets of inverted triple-expansion engines, capable of developing collectively, without undue forcing, 3500 horse-power, each set of engines driving a screw. In the same compartment are two surface condensers, two centrifugal pumps and engines for driving them, fan engines, steam bilge pump, evaporator and distiller, air-compressing engines, and engine dynamo for the search-light; and lastly, the engine for actuating the rudder, which can be controlled from either the forward or after steering station. Abaft the engine-room are two cabins for the engine-room artificers, then comes the officers' mess-room with its pantry, and last of all, quite at the stern, a large store space. The armament consists of an 18-in. bow torpedo-tube for firing direct ahead; also two 18-in. swivel torpedo-tubes for side firing, which are placed on a turn-table aft. On the forward conning-tower, well elevated above the water-line, is a 12-pounder quick-firing gun, which practically has an all-round range. There are also two 6-pounder quick-firing

guns, one at each side, and finally a 6-pounder placed on a high stand near the stern, having a very extensive range of fire. The depth of the boat being so much greater than is necessary for head room, admits of a water-tight flat, or lower deck; this has been built in the boat just above the water-line, extending from the stem to the forward stokehold, adding greatly to the safety of the craft in case of collision, and below, under the floors of the cabins, are spaces for magazines and stores. The coal-carrying capacity of the Havock is 60 tons, and the supply is placed in bunkers along each side of the boiler compartments, and is estimated to be sufficient for a run of 4000 miles at a 10-knot speed. The complement of officers and men to man this vessel is forty-two, for whom there is sufficient accommodation, but they are rather closely packed. The mean speed of four runs on the measured mile was 26.783 knots; the details of the trials have previously been reported.

The boiler-tubes of the Havock were made from a special quality of soft steel manufactured by the Patent Shaft and Axletree Company, Limited, of Wednesbury. This metal is claimed to be equal to that produced from high-priced Swedish blooms, and is much cheaper. It is also designed to be used for steel fireboxes in locomotive boilers. Other governments contemplate building vessels of the Havock type.

THE HORNET.

[*Engineering, March 2.*]

On Friday last a trial was made of the new torpedo-boat destroyer Hornet, which has been built by Messrs. Yarrow & Co., of Poplar, to the order of the Admiralty. The event is memorable in more respects than one, but chiefly because the highest speed afloat has once more been exceeded, the Hornet at the present time standing at the head of all craft in regard to swiftness of steaming, at any rate so far as a well authenticated official trial is concerned.

The Hornet is a sister vessel to the Havock, built by the same firm, the two being alike in all respects, excepting as regards their boilers and boiler fittings; that is to say, the dimensions of the hull and engines are alike throughout. The Hornet is 180 ft. long and 18 ft. 6 in. wide, and is of the usual torpedo-boat construction in general appearance. A view of the sister ship, Havock, appeared in our issue of January 19 (see page 67 *ante*). The Hornet, however, has no less than four funnels to serve her eight boilers, and in this respect differs essentially from her sister ship; with this exception, the two vessels are identical in appearance. In a former issue we gave some particulars of the construction of these vessels, so we need not here repeat the details at length. The hull is divided into thirteen compartments by water-tight bulkheads, 76 ft. amidships being devoted to machinery space, and 30 ft. abaft this is the wardroom and cabin, where the officers are berthed, whilst the crew is accommodated forward, the space under the turtle-back affording a commodious fore-peak. The full complement is 42, officers and crew. These boats differ from the torpedo-boats proper in having at the ends water-tight flats, which give the security of a double bottom. The bunker capacity is 60 tons, which gives a radius of action, on fuel carried, of 4000 miles at 10 knots; so that the vessels may be considered "ocean-going" in the widest sense, as they would never be likely to be required to go out of steaming distance of a British coaling port in time of war. The armament consists of one 12-pounder and two 6-pounder guns, one pair of swivel torpedo-tubes on deck, and a built-in torpedo-tube in the bow. These dischargers are for 18-in. torpedoes. On her trial the mean draught of the hull of the Hornet was 5 ft., but if the propeller be included the draught would be 7 ft. 6 in., as the blades project below the bottom. The displacement would be about 220 tons at this draught.

The torpedo-boat destroyers are all twin-screw, and the engines in the

Hornet are of the ordinary tri-compound torpedo-boat type, designed by Messrs. Yarrow. The cylinders are 18 in., 26 in., and 39½ in. in diameter, the stroke being 18 in. There is a separate cylindrical condenser to each engine. The usual air-compressing, distilling, electric light, and other auxiliary machinery are carried. There are a 24-ft. whaleboat, and two 20-ft. Berthon boats. The safety valves on the boilers are arranged to lift at a pressure of 180 lbs. to the square inch.

The boilers, as already intimated, are the most interesting feature in this boat; none the less so because she forms a unit of a group of Navy vessels which are being devoted to one of the most important series of experiments ever made in the field of marine enginering. It is needless to remind our readers in detail of the events which have led up to what we may now fairly call the introduction of the water-tube boiler in service afloat. Water-tube boilers have, of course, been tried in former years, and on a large scale; but the experiments have been more or less disastrous; always to the pockets of the adventurers, and sometimes even to life. It is only since the torpedo-boat builders have turned their attention to the subject that any substantial measure of success has been obtained in this country; and the performance of the Hornet on Friday last is one of the most important events in this march of progress. On page 79 of our fifty-first volume we gave an illustration of the Yarrow boiler as then designed, and the Hornet's eight boilers are substantially of the same type; the most notable difference being that the special downflow pipes originally provided have been discarded, experience having shown them to be unnecessary. On page 612 of our last volume we fully discussed this part of the subject. The Hornet's boilers have 1-in. tubes of copper to connect the upper to the two lower horizontal cylinders. The heating surface in each boiler is 1027 square feet, and the bar surface 20.6 square feet, the bars being 6 ft. 6 in. long. The weight of each boiler with water and all fittings is 5 tons 7 cwt., and it has been found on test that a single one of the Hornet's boilers will evaporate 12,000 lbs. of water per hour. The boilers are arranged in two groups of four, and are placed in two separate stokeholds.

The arrangements for Friday last were to start at 9 A. M., the trial having to be made on the Maplin mile, for the speed these vessels run, and their size, precludes them being tried even in the Lower Hope, much less in Long Reach, the original trial course of torpedo craft when they were of smaller dimensions. Shortly before the time for starting fires were not lit, and, to the torpedo-boat engineer whose practice was not quite up to date, it would have seemed as if the start were likely to be delayed. However, water-tube boilers alter conditions, and little more than twenty minutes after fires were lit there was steam, and when the party went on board at 9 20 the vessel was immediately loosed from her moorings and proceeded down the river. The weather was favorable for trial trip purposes, the day being one of bright sunshine and moderate breezes, which came happily between periods of river fogs and south-westerly gales. The boat slipped easily down the reaches between Blackwall and Gravesend without a tremor in the hull to denote that the engines were at work; the ease with which she threaded her way between the various craft showing her excellent manœuvreing qualities to perfection. In the Lower Hope stokehold hatches were closed, and the fans were set revolving at a more rapid speed, and soon the low Essex shores of Sea Reach were passed at a speed which gave earnest of what was to come. By the time the section posts which mark the Maplin mile were reached, the engines had worked up to the required power, and the speed test was at once commenced. The first mile was entered with steam blowing violently from the safety valves in a manner which showed that there was, at any rate, no lack of boiler power. Six runs were made on the mile, and the vessel then steamed out past the Mouse Lightship and up Sea Reach into the Thames. The mean speed attained was 28.02 knots, the best pair of runs showing a speed of 28.333 knots.

It will be remembered that a previous trial had been made with this vessel when she had only four of her eight boilers on board, and on that occasion she made 23.3 knots. The run of Friday last, however, was the first made after the boat had been completed, and that so successful a result should have been attained without preliminary trials is a matter upon which the contractors may fairly be congratulated; the engines standing the enormous strain put upon them in the most satisfactory manner. The absence of vibration was a marked feature, and was doubtless due to the system of balancing the engines which has been worked out by this firm.

Although the Admiralty representatives were on board, Mr. Pledge representing the constructive branch, and Mr. Harding the engineering department, this was not an official, or rather a "taking over" trial, and we have little doubt that the contractors will be able to get an even better speed, if they are so minded, when the final test is made. Although the safety valves were blowing when the runs on the mile commenced, and lifted again towards the end of the trial, the full 180 lbs. pressure was not maintained throughout, the average steam being but 172 lbs., and the air-pressure for draught was no more than $1\frac{1}{4}$ in. of water; 5 in. being allowed under the terms of the contract. What was the power developed by the engines we are not aware, but the contract provides that 3600 indicated horse-power should be given, the contract speed being 27 knots. Mr. Yarrow takes 16 lbs. of water evaporated per indicated horse-power per hour as the normal figure for torpedo-boat engines, and as each of the Hornet's boilers will evaporate 12,500 lbs. of water per hour, each boiler would give steam for 781 indicated horse-power, or 6248 indicated horse-power for the eight boilers. In the absence of full information as to the conditions under which the evaporative test of the boiler was made, the figures must be taken as simply tentative, but in any case there is no doubt that the boilers could be driven, under the conditions of contract, at a much greater rate. Whether the present engines would take the steam is a matter upon which we cannot pass an opinion, but with boilers that supply such ample quantities with so much ease, some sacrifice in economy in the engines might easily be made in order to get a greater total power. During a part of the running we had an opportunity of being in the stokehold, and can bear testimony to the ease with which the steam was kept under control—a feature which has not characterized all water-tube boilers in times past—and the facility with which the feed was regulated. The latter point has been one which has been looked on as the particular difficulty with which those who introduce water-tube boilers in groups would have to contend. In the Hornet there are two groups of four boilers each, the whole of the steam generated being taken to the two sets of engines. Messrs. Yarrow's feed arrangements, to judge by Friday's run, meet all requirements in this respect, the water level in the boilers being kept constant, and there were no signs of priming or water in the engine cylinders.

The Hornet's boilers weigh about 11 tons less than those of the Havock, which vessel has two ordinary loco-marine boilers. There is, however, the additional advantage of the greater volume of steam (the contract pressure is the same in both vessels, but the trial pressure was higher with the Hornet) obtained from the water-tube boilers. On trial the Havock's machinery developed 3400 indicated horse-power, the air pressure for draught being under 3 in., and the boilers with water and fittings weighed 54 tons, as against 43 tons for the Hornet. The boiler compartments occupy the same space in both vessels. The Havock made 26.783 knots with 165 lbs. of steam in the boilers, and 362 revolutions per minute. Taking the propellers and engines of both vessels to be alike, we can get an idea of the superior steaming of the water-tube boiler—on 11 tons less weight—if we consider the additional revolutions required for the 28 knots of the Hornet over the 26.78 knots of the Havock, and the 7 lbs. higher pressure of the former over the latter, together with the $1\frac{1}{4}$ inch air pressure of the Hornet with the, say, $2\frac{3}{4}$ inch air pressure of the Havock.

What the revolutions on the Hornet's trial averaged throughout the run we are not aware, but they could hardly have been less than 400 per minute.

The Hornet is at present the fastest steaming vessel afloat, but how long she will continue so is a question. Messrs. Normand & Co. are now constructing at Havre a sea-going torpedo-boat, to be named the Forban, which is designed to attain the speed of 30 knots. The reputation of M. Normand as a scientific engineer and naval architect stands too high to allow us to doubt that his estimate of speed to be attained is well grounded, so that if the Forban does not quite reach the speed promised, she will be somewhere in the neighborhood of it. Messrs. Yarrow have for some time past been offering 30 knots if any Government cares to pay for it; and, naturally, these excessive speeds are costly. Our own Government have not thought it necessary to stipulate for the best that can be done, and doubtless we shall again see the British Navy ceding the pride of place to a foreign power in this respect. The Forban is considerably less than the destroyers, being but 144 ft. 3 in. long and 15 ft. 3 in. wide, her draught being 10 ft., and her displacement 130 tons. The indicated horse-power expected is 3200. She will be a first-class torpedo-boat. M. Normand has already made a speed of 27.22 knots with a vessel of this size when exerting 2700 indicated horse-power. Experience at these excessively high speeds is rare at present, but M. Normand has as much of it at his command as most persons. On the figures quoted, however, it seems as if the estimate were somewhat sanguine.

It will be remembered that the Nibbio, a torpedo-boat built for the Italian Navy by Mr. Schichau, of Elbing, made 26.8 knots so long ago as 1888. This vessel was 151 ft. 8 in. long, 17 ft. wide, and 7 ft. 6 in. draught. She had two locomotive boilers, and tri-compound engines. The indicated horse-power was stated to have been 2000, and the air-pressure 1½ in. The displacement on trial was 145 tons, of which 14 tons were coal and 7½ tons crew, torpedoes, equipment, spare gear, etc. The Nibbio was illustrated and described in our issue of December 6, 1889. Since that time Mr. Schichau has attained a higher speed, his best figure being, we believe, 27.4 knots.

The trials of the other torpedo-boat destroyer will be looked forward to with interest. The orders have been widely distributed, so that many firms of engineers and shipbuilders will have a chance of burning their fingers with this very ticklish kind of craft, and water-tube boilers of all kinds are to be tested, including the Thornycroft, Yarrow, Normand, White, Babcock, and Blechynden.

THE HAZARD.

The new torpedo gunboat Hazard, which was launched from Pembroke Dockyard on Saturday, is the second of the Dryad class, the latter having been recently launched from Chatham. Three others of the same type are in a forward state at Devonport. The Hazard has been built from the designs of Mr. W. H. White, C. B., and is of the following dimensions:—Length 250 ft., beam 30 ft. 6 in., and displacement 1070 tons, at which her draught is 9 ft. She has been fitted with twin-screw triple-expansion engines using steam at 155 lbs. and capable of developing 3500 indicated horse-power, and of driving her at 19½ knots. She has four boilers of the modified locomotive type, and closed stokeholds are used for forced draught. The bunker capacity is 100 tons. The Hazard will be armed with two 4.7 in. and four six-pounder quick-firing guns, and fitted with five tubes for discharging Whitehead torpedoes. She was launched with her engines and boilers fitted on board.

THE HARRIER.

The Harrier, gunboat, just launched at Devenport, is one of the eighteen torpedo-gunboats provided for under the Naval Defense Act of 1889. Lord G. Hamilton's programme, which will be completed this year, provided for the

construction of these vessels, with a displacement of 735 tons, the same as the Sharpshooter type. Under these conditions the vessels were failures, and to effect improvements it was decided to increase the tonnage. Consequently the Harrier, which is the first of three of the new type building at Devonport, has a displacement of 1070 tons. She was designed by Mr. W. H. White, Director of Naval Construction, and she was laid down in January, 1893. She is termed a first-class torpedo-gunboat, unprotected. Her dimensions are: Length, 250 ft.; breadth, 30 ft. 6 in.; mean load draught, 9 ft.; weight of hull, 555 tons; displacement, 1070 tons; coal capacity, 100 tons. The machinery has been manufactured by Messrs. Hawthorne, Leslie & Co., Newcastle-on-Tyne, who also have the contract for supplying the machinery for the Halcyon and the Hussar. The propelling machinery consists of two sets of triple-expansion surface-condensing engines of the vertical inverted type. The engines are capable of developing a collective force of 3500 horse-power on a forced draught trial of three hours' duration, and 2500 horse-power on an eight hours' natural-draught trial. The principal dimensions of the main engines are: Cylinders, high pressure, 22 in.; intermediate pressure, 34 in.; low-pressure, 51 in. in diameter, with a stroke of 21 in. The propellers are of the three-bladed type, and will make about 250 revolutions per minute, which will give an estimated speed of 19 knots with the 3500 horse-power, and 17 to 17.5 knots with the full natural draught power. The armament, which will cost £5570, consists of two 4.7-in. and four 6-pounder quick-firing guns, one bow torpedo-tube, and two double revolving broadside tubes. The total estimated cost of the Harrier is £78,527.

THE TALBOT.

This vessel, which is to be an improved type of the Bonaventure, is about to be commenced on No. 3 slip at Devonport. She will be termed a second-class cruiser. Her dimensions are to be: Length, 350 ft. (30 ft. longer than the Bonaventure); breadth, 53 ft.; mean load draught 20 ft. 3 in.; displacement at load draught, 5500 tons. The engines, which have been ordered at Keyham, and which are in a forward state, are to be capable of developing an indicated force of 9600 horse-power with forced draught, and 8000 horse-power with natural draught. With the 9600 horse-power, the vessel if expected to attain a speed of 19.85 knots per hour, and with the natural draught a speed exceeding 18 knots per hour. The armament will consist of five 6-in., six 4.7-in. and nine 6-pounder and 3-pounder Hotchkiss quick-firing guns. The Talbot will also be provided with bow, stern, and broadside torpedo-tubes, and Maxim machine guns. The cost of the Talbot will be about £300,000.

THE MONARCH.

The third-class armored turret battleship Monarch has been undocked at Chatham. The vessel, which was first commissioned so long ago as May, 1869, has been undergoing a thorough reconstruction, and the work is now almost finished. It has been decided to alter the rig of the Monarch, and for this purpose her lower masts will be removed. Messrs. Maudslay, Son & Field have the contract for supplying the new machinery. The total cost of the reconstruction of the Monarch is estimated at £35,300. The original cost of building her was close upon £480,000, and during her career of nearly a quarter of a century a further sum of of £290,000 has been spent upon her, in addition to the present outlay.

TORPEDO-BOAT NO. 19.

One of the new type of first-class torpedo-boats (No. 19) ordered in 1892, designed and built by Messrs. J. I. Thornycroft & Co., was launched from

their shipyard at Chiswick on the 5th inst. The vessel will be fitted by her builders with a four-cylindered triple-expansion engine driving a single screw, steam for which will be supplied by two Thornycroft water-tube boilers designed to develop sufficient power to propel her at a guaranteed speed of 23½ knots on a continuous three hours' trial. Her armament is to consist of three 3-pounder quick-firing guns, and she is fitted with three tubes discharging 18-in. torpedoes.

THE SPEEDY.

The new first-class gunboat Speedy, which has been commissioned for a series of experimental trials, was subjected to a full power trial at the mouth of the Thames on March 1st, under the superintendence of officials representing the Admiralty, Sheerness Dockyard, and the Medway Fleet Reserve. The results of the trial were very satisfactory. With a mean pressure of 177 lbs. of steam and the engines registering 207 revolutions a minute, a mean of 3071.2 indicated horse-power was registered, with an average speed of 17 knots. These results were obtained under natural draught. The Speedy returned to Sheerness harbor, and will at once complete the preparations for her departure for Portsmouth, where her experimental trials are to take place.

ORDNANCE OF THE CENTURION.

The new battleship Centurion, just completed at Portsmouth, has finished her ordnance trials, which were of special interest, owing to the mounting and loading gear being by Sir Joseph Whitworth & Co. The armament consists of four 10-in. 29-ton guns mounted in redoubts; ten 4.7-in. quick-firing guns, of which four are carried in armored casemates; eight 6-pounder and twelve 3-pounder Hotchkiss quick-firing guns; a complement of field and machine guns; and seven torpedo-tubes, two being submerged. The chief features in the ship are the disposal and mounting of the main armament, which is arranged to fire through an angle of training of 240 deg., in pairs or independently, and, notwithstanding the weight, which amounts to about 200 tons, including shields, guns, mountings, and turntables, can be worked by either hand or steam appliances, or by both in combination. The mountings have been specially constructed to secure high-angle fire.

The heavy guns and their mountings are contained in a couple of redoubts, which are, in fact, a blending of the two methods in vogue (turrets and barbettes); that is to say, while the 10-in. walls of the redoubts are circular and vertical like a turret, they are fixed like a barbette. They differ from the barbettes in the fact that they are built up in segments and not in flat slabs. The redoubts are topped with nickel steel hoods or shields for the protection of the gun crews, these shields being carried on the turntables and rotating therewith. The shields, which are pear-shaped in plan, slope upwards and backwards.

FRANCE.

FRENCH SHIPBUILDING IN 1894.

The programme of shipbuilding which was adopted in 1892 upon the initiative of M. Barbey, and for which a credit of forty million sterling was voted, to be spent within a period of ten years, is being actively carried out in France. By the end of 1902 the country will possess, in the language of

French marine engineers, eighty-one new units, of which fifty-six will be very fast cruisers. These are expected to develop a speed of 19 or 20 knots, while the torpedo-boats will steam at the rate of 24 or 26 knots. The battleships will attain a speed of a little more than 17 knots. These vessels will thus be, if not superior, at least quite equal to the best ships constructed abroad. The reason why an expenditure of forty million is spread over a period of ten years is twofold. In the first place, the French shipyards have not had, until recently, many facilities for rapid construction, though great progress has lately been made in this direction, and such vessels as the Brennus, now afloat, Jaureguiberry and Lazare-Carnot, are not taking more than five years, which, all things considered, compares favorably with the four years required for the building of a battleship in England. It is also considered to be an unwise policy to follow the lead of England and Italy, who build their ships all at once, under the influence of a scare, with the result that a large number of vessels may thus very soon become out of date. It is preferable, in the opinion of French engineers, to carry out a systematic programme, which will allow of the designers keeping up with the progress of scientific construction. Not a few of the vessels that had lain upon the stocks for some time have been very much altered and modified during the course of building. In the present year, according to the naval programme, no fewer than thirty-two vessels will be put upon the stocks. They will comprise three ironclads, five second-class cruisers, and one third-class, one sea-going torpedo-boat, five first-class torpedo-boats, four second-class, and thirteen other vessels and torpedo-boats of various descriptions. It must be borne in mind, however, that the progamme of new vessels for the past year is not yet completed. The first-class cruiser Jeanne d'Arc, and the second-class cruiser Catinat, which ought to have been put upon the stocks in 1893, have not yet been begun; nor have contracts been entered into for the construction of two sea-going torpedo-boats, the Ténare and Cerbère. In order, therefore, to keep pace with the programme, the number of vessels put in hand this year ought to be thirty-six. Among the ships to be begun this year are three ironclads, each of 11,000 tons, and carrying four guns of 30 cm., placed in two turrets. The Charlemagne will be constructed at Brest, and the Saint-Louis at Lorient, while the Henri IV. will be built by private firms, with whom, however, the contract has not yet been signed. The five second-class cruisers are of two types. Three of them will be of the Descartes type, and as they are required for the tropical seas, their hulls will be encased in wood and sheeted with copper. They will have a displacement of 3990 tons, and the engines of 9000 horse-power are expected to develop a speed of 19 knots. The armament will be composed of four 16-cm. guns, ten of 10 cm., fourteen of 47 mm., and four of 37 mm., all quick-firing. The two other cruisers will be attached to the squadrons. Having a displacement of 3800 tons, their engines will be of 9100 horse-power, and the speed is estimated at a little more than 19 knots. They will carry six 16-cm. guns, four of 10 cm., eight of 47 mm., and twelve of 37 mm., all quick-firing. Of these five cruisers four will be built by private firms, and one will be constructed at the Cherbourg arsenal. The third-class cruiser was lately put upon the stocks at Rochefort; she will be of the Linois type, and is expected to develop a speed of 20 knots. The sea-going torpedo-boat will be built upon the lines of the Forban, which, with forced draught, is said to be capable of attaining a speed of 30 miles an hour. The five first-class torpedo-boats will have engines of 1350 horse-power, and are expected to develop a speed of 23½ knots. Of the nine torpedo-boats required for the Foudre, now under construction at Bordeaux, three have already been ordered, two in France and one in England, which latter will be built of aluminium. If this work is put in hand this year it will provide a great deal of employment at the shipyards and steelworks, which have, indeed, been working full time since the first contracts under the new programme were given out. Nevertheless, there is a danger that work will be delayed at the shipyards, at some of which the hands have struck in favor of a higher rate of wages.

It appears that France will have in 1894, either actually under construction or in immediate contemplation, no less than ten first-class battleships, four so-called coast-defense battleships, nine first-class cruisers, fourteen second-class cruisers, and four third-class cruisers, without reckoning a large number of smaller craft of various descriptions and a considerable flotilla of torpedo-boats. England has under construction at the present moment a small residue of the ships provided under the Hamilton programme of 1889, all but nine of which will be completed before the end of the current financial year; the battleships Renown, Majestic and Magnificent, the two latter of which have only just been begun; the first-class cruiser Powerful, three second-class cruisers, and two sloops, together with a considerable number of torpedo-boats and torpedo-boat destroyers of a new and improved type.

THE BAYARD.

According to a telegram from Cannes to the *Echo de Paris*, the trial trip of the ironclad Bayard took place on Monday, Feb. 19, and it was intended the vessel should then be sent to the China station. The result, however, was very unsatisfactory. She had been only about two hours at sea after leaving Toulon when it was discovered that she was leaking extensively. The pumps were set to work, but the water continued to gain steadily, and the provision floors were flooded. It was found necessary to retourn to Toulon, and the ship was inspected by a committee of officers on the 20th inst.

THE FORBAN.

The following are particulars of the sea-going torpedo-boat Forban, which is now being built at Havre by MM. Augustin Normand & Co., and which is designed to attain the extraordinary speed of 30 knots or 34½ statute miles an hour: Length, 144 ft. 3 in.; beam, 15 ft. 3 in.; draught, 10 ft.; displacement, 130 tons; indicated horse-power, 3200. The vessel will have twin-screws, and will carry two torpedo-ejectors and two 1.46-in. guns. The Forban will be by far the fastest craft afloat. The Chevalier, a torpedo-boat of the same length, but of only 2700 indicated horse-power, was recently delivered by MM. Normand, and has attained a speed of 27.22 knots. The boilers which give these striking results are a speciality of the firm of Normand, and are, it is understood, to be adopted for the new British torpedo-boat destroyers Janus, Porcupine and Lightning, under construction by Messrs. Palmer & Co., of Jarrow, and for the Rocket, Shark and Surly, under construction by Messrs. J. & G. Thomson, of Clydebank. Of the numerous sister ships that have been ordered, the Conflict, Teazer and Wizard, building by Messrs. J. S. White, of Cowes, are to have Mr. J. S. White's boilers, constructed by Messrs. Maudslay, Sons & Field; the Fervent and Zephyr, building by Messrs. Hanna, Donald & Wilson, of Paisley, are to have locomotive boilers; the Swordfish, building by Sir W. G. Armstrong, Mitchell & Co., is to have Babcock and Wilcox boilers; and, probably, the Skate, Starfish and Sturgeon, building by the Naval Construction and Armaments Company, at Barrow, and the Sunfish, building by Messrs. Hawthorn, Leslie & Co., of Hebburn, will have Blechynden boilers. Yet other vessel of the class will have Yarrow, Thornycroft, Belleville or Du Temple boilers; so that the trials of the destroyers should afford a fairly good indication of the merits of the various British and French systems.

THE CHANZY.

A further addition has lately been made to the Navy of France by the launch on the 24th ult. at Bordeaux of the armored cruiser Chanzy. Her principal dimensions are: Length, 347 ft. 7 in.; beam, 45 ft. 9 in.; and displacement at a mean draught of 19 ft. is 4745 tons. Her propelling machinery

consists of two triple-expansion horizontal engines, each driving a screw propeller, capable of developing 7400 indicated horse-power under natural draught, and 8300 under forced draught, giving the vessel a resultant speed of 17 and 19 knots an hour respectively. She is armor protected from end to end by a belt 3.6 in. thick, and has an armored deck throughout her length, varying from 1.5 in. to 3.9 in. in thickness. Her armament comprises two 7.4-in. breech-loading guns, one on the poop and the other on the forecastle; and six 5½-in. quick-firing guns in sponsons—three on each broadside—which are all mounted behind armored shields 3.6 in. thick, in separate revolting turrets worked by electricity. She also carries four 2.5-in. 9-pounder and six 1.8-in. 3-pounder quick-firing guns, and six 1.45-in. 1-pounder Hotchkiss revolving guns, mounted behind bullet-proof shields only. There are, also, in addition to this armament five torpedo-ejectors, one on each bow and beam and one astern. The vessel has two funnels and two masts, the latter having armed military tops of the usual type. The Chanzy is the third vessel of her class already launched, her two sister-ships being the Latouche Tréville and the Charner; a fourth being still under construction at Rochefort.

RUSSIA.

THE SEVASTOPOL, PETROPAULOVSK AND SISSOI VELIKI.

As soon as the state of the ice permits, the three Russian battleships, Sevastopol and Petropaulovsk, each of 10,960 tons displacement, 10,600 indicated horse-power, and 17 knots speed, and Sissoi Veliki, of 8880 tons displacement, 8500 horse-power and 18 knots speed, will be launched at St. Petersburg. The two first-named ships will each mount four 12-in., eight 8-in. and twenty-four smaller guns; the third will carry four 12-in., six 6-in. and eighteen minor weapons. Each vessel has a complete water-line belt with a maximum thickness of 16 in.; and the two larger have 10-in., while the smaller has 14-in. armor on the turrets.

JAPAN.

THE YOSHINO.

The Yoshino is a protected cruiser 350 ft. long, 46½ ft. broad, and her displacement at load-draught is about 4000 tons. "She is the fastest sea-going vessel in the world—faster a good deal than anything in the United States Navy," so says the *Engineer*, "but most people will reserve their decision until they hear how the speed was measured. If by patent log it will be safe to deduct two or three knots.

The Yoshino is the same class of vessel as the 9 de Julio and 25 de Mayo, constructed by the same firm for the Argentine Government, but exceeds either of them in size and speed, and is, moreover, provided with a double bottom, which they have not. The results of the speed trials carried out last July off the mouth of the Tyne far exceed any yet obtained from a sea-going vessel, and prove her to be the fastest cruiser now afloat, a fact having this significance, that there does not exist anything in the form of a ship that could escape from her if pursued.

During the natural draught trials the ship attained a mean speed of 21.6 knots, with forced draught 23.031 knots or 26.51 miles per hour. At the turning trials it was shown that the ship could turn through 360 deg. in three

minutes eight seconds ; the diameter of the circle measuring 375 yards. This was considered a remarkably small circle for a vessel of the length of the Yoshino. The helm could be put from hard-a-port to hard-a-starboard in thirteen seconds, and the engines could be reversed from full speed ahead to full speed astern in a few seconds. The vessel thus possesses in a very high degree the handiness and manœuvring power which are so essential to a cruiser of this class.

The armament of the vessel consists of four 6-in., eight 4.7-in., and twenty-two 3-pounder quick-firing guns, and five torpedo tubes. One 6-in. gun is placed on the forecastle, and one on the poop, each gun being capable of firing through an arc of 270 deg., or all round the bows to 45 deg. abaft the beam on either side for the forward gun, and round the stern to the same angle before the beam on both sides for the after gun. The other two 6-in. guns are carried in sponsons at the level of the upper deck, one in each bow, and have a range of fire from 3 deg. across the bow to 60 deg. abaft the beam. The eight 4.7-in. quick-firing guns are carried in sponsons at the level of the upper deck, the aftermost pair being close to the poop, and firing from 3 deg. across the stern to 60 deg. before the beam, and the other six—three on each side—have each a range of 120 deg. The twenty-two 3-pounder quick-firing guns are disposed as follows :—Two at the after end of the forecastle—one on each side—so as to get a training arc of about 80 deg. abaft the beam, and two similarly placed on the poop ; four are placed in the military tops, two in each ; eight on the upper deck bulwarks, and the remainder between decks, thus obtaining a complete command of every possible direction of approach to the ship. One of the torpedo tubes is in the stem for right-ahead fire, the other four are training tubes, and fire on the broadside, two being placed in a chamber forward on the main deck, immediately before the machinery compartments, and the other two in a similar chamber aft of these compartments. Her machinery worked most satisfactorily throughout the whole of the trials, and the Japanese Government may be congratulated on the possession of one of the finest, swiftest, and most powerful warships of her class afloat.

ARGENTINE REPUBLIC.

Messrs. Laird Brothers launched from their works at Birkenhead on Thursday, December 28, a twin-screw steel torpedo-cruiser built to the order of the Argentine Government. This is the fifteenth vessel built by this firm for the Argentine Navy. She was named Patria. The Patria may be described as an enlarged and improved vessel of the Halcyon type in the British Navy. An important departure from the vessels of her type in the British Navy is the substitution of a complete spar-deck for the poop and forecastle. She has a length of 250 ft., with 30-ft. beam and 16-ft. depth, and her tonnage is 1183 tons O. M. The machinery, which is complete in Messrs. Laird's shops ready for putting on board, consists of two sets of triple-expansion engines of 1250 horse-power, each driving a three-bladed propeller with steel boss and manganese bronze blades ; distillers and evaporators of large capacity, and complete electric installations in duplicate are provided. The boilers are of steel, four in number, of the locomotive type, working at a pressure of 156 lb. per square inch, to be worked under the closed stokehold system. The armament will comprise quick-firing guns, machine guns, and five torpedo tubes.

BRAZILIAN TORPEDO-BOATS.

The Government of Marshall Peixoto, at Rio, purchased from Herr Schichau, the well known shipbuilder of Elbing, five of his 152-ft. torpedo-boats, for use against the insurgent Brazilian vessels commanded by Admiral Mello. After leaving Elbing the little vessels experienced such heavy weather in the Baltic and down the Channel that they had to put into Dartmouth for shelter, where they remained until the late December gales had blown themselves out. Crossing the Bay of Biscay in safety and without mishap, they filled up with coal at St. Vincent, and from thence proceeded on their voyage at their most economical speed—12 knots with one boiler—so as to have a reserve of coal on arrival. On this part of their voyage the speed of these boats was so well and regularly maintained that all were safely in port at Pernambuco within twelve hours of the arrival of the first. Each boat was in charge of a German captain, who took with him a German crew of fifteen men. No mishap occurred throughout the voyage, thereby proving that such vessels can cross the Atlantic without risk, and, if needed, be ready to go into action on arrival.

THE SWEDISH NAVY.

The Swedish Naval Minister proposes a five years' plan for the increase of the Navy, a plan which, however, involves a total calculated outlay of 10,622,000 kr., or about $2,900,000. This amount is expected to cover the following items: In 1895, half the cost of an ironclad, and the commencement of a despatch boat. In 1896, the completion of the ironclad, the building of a first-class mine boat, the completion of the despatch boat, and the commencement of a transport steamer. 1897, half the cost of an ironclad, three first-class mine boats, one second-class mine boat, and the completion of the transport steamer. In 1898, the completion of the ironclad, the building of three first-class mine boats and two second-class mine boats. In 1899, half the cost of an ironclad, three first-class mine boats, and three second-class mine boats. There are already funds in hand for half the cost of an ironclad.

THE CATÀSTROPHE ON BOARD THE GERMAN S. S. BRANDENBURG.

[*The Engineer.*]

Among the records of engine-room accidents, the failure of a steam pipe on board the German ironclad Brandenburg holds an evil and overwhelming pre-eminence. Since the explosion of a boiler on board H. M. S. Thunderer, nothing at all approaching it in magnitude has been heard of. In that ship a boiler, one of eight, intended to carry 30 lbs. pressure, exploded on the 14th of July, 1876. Fifteen persons were killed on the spot, sixty-three were injured, of whom twenty-four died soon afterwards. On October 21, 1887, while the Elbe was undergoing a trial in Stokes Bay, her steam pipe burst, and nine men were killed. But on board the Brandenburg thirty-nine were killed at once. Kiel is an important harbor, playing much the same part for

the German Navy that Portsmouth does for the English Navy. It is situated on Kiel Bay in the Baltic, due south of the Danish island Fuenen. On Friday, the ironclad Brandenburg ran down the bay to the trial ground near Buelk Lighthouse. She was proceeding under easy steam when her starboard main steam pipe burst. The engine-rooms, in which at the time were about fifty men, instantly filled with steam. Thirty-nine were at once scalded to death, and nine were injured, of whom two have died. A longitudinal bulkhead separates the engine-rooms, but the door of communication was open, and through it the steam rushed, carrying death with it. The steam appears to have ascended through the lower hatchways, and found its way along the lower deck, killing a cook in his galley at a considerable distance forward of the engine-room. No one in or about the engine-room escaped, save one man who was at the head of a ladder on the upper platform; he fled for his life and escaped unharmed. The ship was disabled, and steamers were sent from the dockyard to her assistance. As to what actually took place nothing is known with certainty. According to one account, the copper steam pipe ripped open; according to another the failure took place in the main stop valve box, which was broken off from the steam pipe. A slightly different version is that an elbow close to the stop valve box gave way. The chances are all against any complete information being made public. There will be a very full Government inquiry, no doubt, but the evidence is pretty certain to be withheld. Unfortunately, however, the engineering world is too familiar with steam pipe failures to require much enlightenment. It may, we think, be taken as certain that a copper steam pipe has given way, and on that fact we may concentrate our attention.

On another page will be found a view of the Brandenburg at sea. She was built at Wilhelmshaven, and launched two year ago. She is a twin-screw belted cruiser, 9840 tons displacement, and intended to indicate 10,000 horse-power. She is 354 ft. long by 64 ft. beam, and draws 24 ft. 6 in. The Brandenburg is very similar to the Kurfürst Friedrich Wilhelm, Weissenburg, and Wörth. Her belt varies in thickness between $15\frac{3}{4}$ in. and $11\frac{3}{4}$ in. It is compound. The barbettes are plated with $11\frac{3}{4}$-in. compound armor. The deck-plating is $2\frac{1}{2}$ in. She carries six 28-cm. breech-loading rifles, and the same number of $10\frac{1}{2}$-cm. quick-firing guns, besides eight 8.7-cm. quick-firers, and a number of machine-guns, and seven torpedo-tubes. She is intended to steam at 16 knots. Her machinery was supplied by the Vulcan Works, Stettin.

At the time of the catastrophe she was getting ready for her forced draught trial, and appears to have had steam up nearly to the blowing-off point. The safety valves were loaded to twelve atmospheres, or 186 lbs., an unusually heavy pressure to carry in the boilers of a man-of-war. Some very funny statements have appeared in the daily press concerning the pressure and the power of the ship's engines. The most absurd we found in the pages of the *Chronicle*, where it appears especially out of place, because our contemporary is nothing if not a representative of the working man, and working engineers at all events do not mix technical matters in the following fashion:—"It is stated by the chief official Government organ in Berlin that the heat of the steam in the Brandenburg's boilers and steam pipe was 180 deg. Reaumur—that is to say, 437 Fahrenheit, or more than twice the heat of boiling water. No wonder the injuries of the victims of the disaster in the stokehold were so shocking. The fault appears to lie with a new copper steam pipe, which gave way with a pressure of 7200 horse-power, when a previous pipe had sustained a pressure equal to 10,000 horse-power. Perhaps the Emperor, when he penned his message to the captain, hardly realized what is meant by his expression, 'Full steam ahead!' If he did we may admire his *sang froid*, but we can scarcely pay homage to his sensibility." It would be difficult to cram a greater number of blunders into a short paragraph. In the first place, a temperature of 437 deg. Fah. corresponds to a pressure of 370 lbs., or rather more than double that actually carried; in the second place, steam of

this temperature is less likely to scald than that from a tea-kettle. In no case could the temperature be greater, once the steam had escaped, than 212 deg., and it might easily be very much less, because of the cooling effect of the enormous expansion which took place. The gem of the whole paragraph, however, lies in the words "pressure of 10,000 horse-power." This is indeed a distinct addition to scientific terminology, and will certainly be heard of again.

So much has been said and written about steam pipes that it really seems as though nothing was left to be said. Copper appears to possess certain distinct advantages over steel; yet we should, on the whole, be disposed to prefer the use of welded steel or iron pipes to brazed copper. Concerning the latter, there is one matter which has not yet received the consideration which it deserves. In ships it will be found that the steam pipe is constantly in motion. The engines always "work" in a ship, the cylinders are never at rest when the engines are running. In some cases this movement sets up awkward bending stresses in the copper. Now, it so happens that copper—and especially some varieties of it—is extremely intolerant of bending backwards and forwards; thus copper stay-bolts break, and it will be found that in all cases the texture of the metal has lost its fibre, and becomes more or less crystalline. A suggestive example of this recently came under our notice. Certain discs of copper plate about 40 in. in diameter were employed to make expansion joints on a long exhaust steam pipe. The plates were dished and riveted together all round the edges, the flanges of the cast iron pipe being bolted to them at the center. The arrangement is one very common in ironworks. It has been found that the copper plates will not last two months. They crack round the flanges of the pipes. Now it seems to us to be by no means improbable that the "nature" of copper steam pipes may deteriorate from a similar cause in ships. However, nothing of this kind could have operated in the case of the Brandenburg, because the ship and her engines were quite new. Only one hypothesis apart from bad brazing remains to be considered, and that is the possible action of water in the steam pipe. It is, of course, conceivable that the boilers primed, and that water-hammer action was set up. Again, as the ship was running very slowly, it is possible that water accumulated in the pipe, and that on opening the stop valve more fully an accident occurred. This is what actually happened on board the Grimsby, a Manchester, Sheffield and Lincolnshire Railway Company's steamer, on the 14th of July, 1892. Water accumulated in the main steam pipe, and on opening the stop valve this was projected forward, and burst the pipe by hammer action. On the 12th of March last year a stop valve chest was smashed up at the works of Messrs. Ashton Bros., Hyde, near Manchester, from the same cause. Owing to vibration caused by the "working" of the engines in the Othello fishing smack, a copper steam pipe burst on the 10th of June, 1893; while a flange was broken off the steam pipe of the S. S. Astrakan by the impact of water on the 16th of June in the same year. Thus it will be seen that there is nothing far-fetched in the assumption that water may have played an important part in bringing about the dreadful catastrophe which we record. The lesson is, of course, that ample drainage for steam pipes ought invariably to be provided, and that no unwoulded steam pipe should be used. Square steel wire is now employed for this purpose by many firms, steel hoop driven on by others. Even if these things fail to prevent the cracking or splitting of a pipe, they effectively limit the consequences to more or less insignificant proportions, and their presence gives confidence. The time is perhaps not distant when the use of unreinforced copper pipes will be prohibited; first, by the common sense of engineers; and secondly, by the Board of Trade.

We cannot lay down our pen until we have expressed our sympathy with the relatives of the men who have died while discharging their duties. There is certainly no English engineer who has not heard of the calamity with pro-

found regret. If the breakdown was the result of an error in design or manufacture, we can pity the blunderer. But we shall refuse to believe that any human skill or foresight could have avoided the blow which has fallen on the German Navy, until very positive and trustworty evidence to that effect is forthcoming.

THE BRITISH NAVY ESTIMATES.

[*Engineering.*]

The sum asked from Parliament for the ensuing year is 17,366,100*l.* This is the net amount of the proposed expenditure, in addition to which there are "appropriations in aid" equal to a sum of one million odd; so that the gross estimates are 18,371, 713*l.* The net increase over last year's estimate is 3,126,000*l.* The chief excess over last year is to be found under shipbuilding, repairs, maintenance, etc., wherein we find an additional charge for the coming year of 1,654,200*l.* for the section referring to contract work. This year (1893–94), 1,266,000*l.* was spent amongst contractors under the estimates. During the coming year, *i. e.*, that which begins with the first of next month, the proposal is to spend 2,920,200*l.* In comparing figures it must be remembered that the Naval Defense Act of 1889 provided for the expenditure during seven years of 10,000,000*l.* for contract work. This sum was to be made up by an annual charge on the Consolidated Fund of 1,428,571*l.*, and the last payment would, under the original arrangement, become due in the financial year ending March 31, 1896. There only remains, however, a total sum of 16,632*l.* to be spent next year, the work representing the balance having been already done. It will be seen, therefore, that the naval programme of 1889 is practically completed.

Turning from these considerations we find that there is a notable increase in the *personnel* of the fleet; the number of officers, seamen, marines, etc., for which money is taken, being 83,400, an addition of 6700 on last year's figures, the total amount asked for wages being 3,918,500*l.* "Victualing and clothing for the Navy" will absorb 1,402,100*l.*; "Medical services," 143,900*l.*; "Martial law," 10,600*l.*; "Educational services," 79,100*l.*; "Scientific services," 61,600*l.*; and "Royal Naval Reserves," 205,800*l.* These figures absorb net estimates for the first seven votes of the effective services, and bring us to Vote 8, "Shipbuilding, repairs, maintenance," etc. This vote is divided into three sections, as follows: Section I., *personnel*, 1,771,800*l.*; Section II., *matériel*, 2,294,000*l.*; and Section III., contract work, 2,920,200*l.* Vote 9 is for "Naval armaments," and amounts to 1,383,200*l.*; Vote 10, "Works, buildings, and repairs at home and abroad," 650,000*l.*; Vote 11, "Miscellaneous effective services," 173,000*l.*; and Vote 12, "Admiralty Office," 231,200*l.* This brings up the net total for the twelve effective service votes to 15,245,800*l.*

The non-effective services comprise half-pay, pensions, gratuities, etc., the net total for which is 2,060,000*l.* An additional 60,360*l.* for annuity payable under additional service in Australasian waters brings the net total estimates up to 17,366,100*l.*, already stated; the appropriations in aid being 1,005,613*l.*, so that the gross total is over eighteen and three-quarter millions.

Turning to the *personnel*, we find that 1600 boys will be entered from the training ships. In view of the ships lately added under the Naval Defense Act, the natural increment will be insufficient, and the authorities propose entering 800 seamen direct from the mercantile marine and other sources in order to meet present wants, and to meet the objections, in case of war, of having to fall back on too large a number of our reserves.

The number of artificers is to be increased by 350; certainly not too large an addition in view of the added requirements of the service. The increase in stokers desired is 2450.

For contract work, including appropriations in aid, the total is 2,959,700*l.* Amongst the sub-heads which go to make up this amount are: Propelling machinery, 1,227,615*l.*, an enormous increase on last year's estimates, when the amount was 566,890*l.*; auxiliary machinery will absorb 43,004*l.*; hulls of ships building by contract, 1,104,974*l.*—last year the total in the estimates under this sub-head was but 262,694*l.*; contract repairs and alterations will cost 59,300*l.*; inspection of contract work, 31 000*l.*; gun-mountings and air-compressing machinery, 359,171*l.*; machinery for shore establishments at home and abroad, 30,000*l.*; Royal reserve of merchant cruisers, 34,000*l.*; whilst 70,636*l.* for interest on advances under the Naval Defense Act completes the total. In estimating these amounts, in comparison with those corresponding with them during recent years, the influence of the Naval Defense Act must not be forgotten. Thus in 1893–94. the year which ends with this month, the sum 1,039,751*l.* has been spent under the Act, and therefore does not come in the estimates. Of this total, 674,468*l.* was devoted to shipbuilding by contract, and 365,283*l.* to armament. Up to March 31, 1893, 8,943,617*l.* was spent of the total of 10 millions. It will be seen, therefore, that the annual 1,428,571*l.* provided for each of the seven years has been considerably exceeded; and hence the sub-head for interest above quoted. The point to bear in mind, in comparing future estimates with with those of the past six years, is that all the money required for shipbuilding, etc., has not lately been asked for in the estimates, whilst in future, there being practically no Naval Defense Act—there is only 16,000*l.* more to come—the total of the estimates will represent the total expenditure.

Turning to the programme for construction, we find that of the ten battleships of the Naval Defense Act seven will be in commission, and the Royal Oak, Repulse, and Revenge will be ready for service next month. This is a matter upon which the country may well congratulate itself. Certainly no other nation could carry out such a programme in the same space of time. Both the Admiralty and the contractors deserve credit for the magnificent fleet of vessels which has been the outcome of the Hamilton programme. Not only the battleships but the 42 cruisers laid down, except five of the second class, are finished, and these five are far advanced. Of the torpedo-gunboats belonging to the programme, only four remain to be completed. The completion of these ships proves that Great Britain can produce a war fleet worthy of the country within the space of five years. A great deal may happen in the way of naval warfare in a space of time very much less than five years, and, in fact, in probably less than as many months.

In the first Lord's explanatory statement, reference is made to the first-class battleships Majestic and Magnificent, and we are told that the delay in their construction was "owing to the expediency of postponing their commencement until all the circumstances connected with the loss of the Victoria had been thoroughly considered by the Admiralty," and that both vessels shall now be "rapidly advanced." In regard to the two big cruisers, Powerful and Terrible, they also are "now being pushed forward," the delay in giving the orders for these ships has been owing to the time necessarily taken to decide preliminaries.

With regard to the new programme for the coming year, it is proposed to commence seven battleships of the first class, six cruisers of the second class, and two sloops. The main features of the new battleships will follow generally the designs of the Majestic and Magnificent. Five of these vessels are to be built in the Royal Dockyards—two at Portsmouth, two at Chatham, and one at Pembroke. Although these vessels are to be commenced, it is only upon three of them that it is proposed to make "substantial progress"; whilst only "a moderate expenditure sufficient to open out the work" is to be

incurred in regard to the other two. Two of these ships will be contract-built. Turning to the estimates, we find that the estimated total expenditure (excluding armament) on "New Battleship No. 1, at Portsmouth," is 138,528*l.*; on "New Battleship No. 2," at Chatham, it is 160,830*l.*; and on "New Battleship No. 3," at Pembroke, 151,663*l.* Battleships Nos. 4 and 5 will have about 94,000*l.* spent on the two. From these figures may be obtained an interpretation of the official expressions "substantial progress" and moderate expenditure." The six second-class cruisers will be of the Talbot type, and will be built by contract. The number of cruisers is quite disproportionate to the battleships.

The summary of vessels building, independently of the vessels completing under the Naval Defense Act and six torpedo-boat destroyers, is as follows: In the dockyards, eight first-class battleships, three second-class cruisers, and four sloops; in private yards, two first-class battleships, two first-class cruisers, six second class cruisers, and thirty-six torpedo-boat destroyers.

PAUL JONES AND LORD SELKIRK'S PLATE.

[*From a Correspondent in Paris—London Times, March 26, 1894.*]

While examining lately some manuscripts in the French National Archives, I found a curious memorandum by the celebrated Paul Jones, in which he gives, for the information of Louis XVI., a minute account of his exploits during the American War of Independence. He doubtless wrote the narrative in English, and then had it translated into French and transcribed in a plain round hand. The subjoined passages, relating to Lord Selkirk's plate, are, therefore, not in his own words, but have undergone a double translation. They are, however, curious as being his own unpublished version of an affair in which, as usual, he did not fail to sound a trumpet before him:—

"Returning on board the Ranger, the wind being favorable, I sailed for the Scottish coast. My intention was to capture the Earl of Selkirk and detain him as a hostage agreeably to the plan of which I have already spoken [reprisals for the Act of Parliament of February, 1776, declaring American prisoners traitors, pirates, and felons, and for the refusal of a cartel of exchange]. Accordingly the same day (23d April, 1778), about noon, having with me in a single boat only two officers and a small guard, I landed on that nobleman's estate. On landing I met some of the inhabitants, who, taking me for an Englishman, told me that Lord Selkirk was then in London, but that my lady, his wife, and several lady friends were at home. This made me resolve to return immediately to my boat, and go back to the Ranger. This moderate conduct was not to the taste of my men, who were inclined to pillage, burn, and devastate all they could. Though this would have been making war after the fashion of the English, I did not think it fit to imitate them, especially on this occasion, considering what was due to a lady. It was necessary, however, to find some compromise to satisfy the cupidity of my crew, und to spare Lady Selkirk. I had only a moment for choice. What seemed to me best to reconcile everything was to order the two officers to go to the mansion with my guard, which was to remain outside under arms, while they alone entered. They were then politely to ask for the family plate, to stay only a few minutes, to take what was given them without demanding anything more, and return immediately afterwards without proceeding to any search. I was strictly obeyed. The plate was given up. Lady Selkirk told the officers several times over that she was very sensible of the moderation shown by me.

She even wished to come to the beach, a mile from her mansion, to invite me to dine with her, but the officers begged her not to take the trouble to do this. . . . When circumstances forced me to allow my men to demand and take Lady Selkirk's plate, I was resolved on redeeming it at my own expense when it was sold, and on restoring it to that lady. On reaching Brest, therefore, my first care was to write her a touching letter, in which I explained the motives of my expedition and the cruel necessity in which the conduct of the English in America had placed me of inflicting retaliation. This letter was sent in an envelope addressed to the Postmaster-General in London, so that it might be shown to the King of England and his Ministers, and the Court of London was constrained to renounce the sanguinary Act of its Parliament, and to exchange these Americans, 'traitors, pirates, and felons,' for prisoners of war whom I had captured and brought to France. . . . During the war I found no means of returning to the Countess of Selkirk the family plate, which I had been forced to let my men carry off at the time of my expedition in Scotland in the Ranger. I redeemed this plate from my men at a very high price. They fancied they could not make me pay too dearly for it. I had calculated on sending it from Lorient by sea when that place became an open port, but, finding no opportunity, I wrote to the Comte de Vergennes for permission to send the plate from Lorient to Calais by land. That Minister considered my letter, and sent it on to M. de Calonne, who not merely granted me the permission I desired, but wrote me a very complimentary letter. The plate was subsequently forwarded to London and delivered, carriage free, at the address given by the Earl of Selkirk. I received from that nobleman a letter full of gratitude for the delicacy of my conduct and the strict discipline of my men."

In an appendix Paul Jones gives in the original English his letters to and from Lord and Lady Selkirk, most, if not all, of which were published at the time of the restoration of the plate in 1784. They show how he assured Lady Selkirk, writing from Brest on the 8th of May, 1778, that he "waged no war against the fair," but fully intended restitution; how Lord Selkirk sent a reply, which was stopped by the English Postoffice and returned to him; how Lord Selkirk transmitted a message to the effect that he would accept the plate if restored by Congress or any public body, but could not think of being indebted to Paul Jones's private generosity: and how, after the restitution, Lord Selkirk assured Jones that his men stayed only a quarter of an hour in the butler's pantry while the butler was collecting the plate, and behaved very politely. In a letter to an Amsterdam dignitary, also appended, Paul Jones says, "I never had any obligation to Lord Selkirk, nor does he know me or mine except by character."

[*London Times, March 31, 1894.*]

As a sequel to the publication in *The Times* of Monday last of a memorandum by Paul Jones (discovered by a Paris correspondent of *The Times* among the treasures of the national archives of France), describing the seizure of Lord Selkirk's plate, the *Dumfries Courier* reproduces an account of the affair from the *Scots Magazine* for April, 1778, together with a hitherto unpublished letter written by the Countess of Selkirk, dated St. Mary's Isle, April 25, 1778, in which she gives her own version of what happened. In the course of the letter she says: "The visit we had on Thursday was by no means desirable, but I have the satisfaction to be able to assure my friend that I neither was alarmed at the time nor have suffered in the least degree since. They took pains to let themselves be understood a press-gang till they had surrounded the house, and the principal one had asked for me. I went down without scruple; they informed me what they were, and their order was to take my ord prisoner, or, if he was absent, to demand the plate. I was so sensible of

the mercy it was that my lord was absent that I never hesitated about the other. I apprehended the consequence of a refusal or a search to be so much worse that I would not permit the servants to conceal, as they meant to do. I must confess I now regret that, as I might have saved some of the best, for it came afterwards to be firmly believed that they were much alarmed, but at the time that was not observed, and could not otherwise be learned, as nobody was permitted to leave the house." Further on she says:—"I am sure I behaved at the time with the most perfect composure, I may say even indifference, and did what I then thought best. . . . The only real concern which I cannot remove is to think that my lord must be effected if he hears this before he hears from me." She states, also, that "the people really behaved very civilly. . . . The youngest of the officers was a civil-looking lad in American uniform, but it seems had had a blue greatcoat as a disguise. He meddled little. The other, dressed in blue, behaved civilly, but with so confident a look and so saucy a manner that I daresay he could have been very rough had he seen it necessary."

EFFECT OF REVERSING THE SCREW OF A STEAMER ON THE STEERING.

[*The Steamship.*]

Captain John Bain, of Glasgow, a well-known Clyde nautical assessor, lately communicated a paper on this subject to the Institution of Engineers and Shipbuilders in Scotland. The opinions which he offered on the subject were, he said, obtained from personal experience in the handling of half-a-dozen large screw steamers, dating from 1873; and in corroboration of his conclusion he cited endeavors which were made in 1875 by Professor Osborne Reynolds, C. E., F. R. S., of Owens College, Manchester, and a committee of the British Association, to investigate the phenomena that had then been observed in the steering of screw steamers. In pointing out the danger attaching to the reversing of the screw while the vessel was going full speed, he instanced several collision cases which had been heard in the Admiralty and other Courts, where the reversion of the screw of one or both of the steamers colliding appeared to him to be the ultimate cause of the accidents, and which, he regretted, were not taken into consideration either by those who had charge of the vessels at the time of the collision, or by the bar or bench to whom the facts of the case were presented in the course of the inquiry. In addition to a number of other cases referred to, Captain Bain quoted, as an illustration of the effect of putting the helm hard a-starboard and reversing full speed at the same moment the collision between the Thistle, of Liverpool, and an unknown schooner; and, as an example of putting the helm hard a-port and reversing full speed, he adduced the case of the collision between the Thorsa, of Leith, and the Otto, of Hull, in the Baltic last year. Although there were dozens of collisions of a similar nature which he could mention, where the reversion of the screw just previous to the collision was perfectly plain, he contended that those two cases were about as clear and traceable to the effect named as any to be found on record. Stated briefly, Captain Bain said that his contention was as follows: That if the helm is put hard a-port on board a steamer having a right-handed propeller, and going full speed, or nearly full speed ahead, and at the same moment the engines are stopped and reversed full speed, the vessel's head will cant to port instead of to starboard as, mechanically considered, it ought to do, or, in other words, that the vessel's head will in 15 or 20 seconds after the screw is reversed stop canting to starboard and swing 15 or 20 degrees in the direction of the danger which it was intended to avoid. On the

other hand, he held that if the helm is put hard a-starboard in such circumstances as those mentioned, the result will be that the moment the engines are "over the center" to go astern the vessel's head will swing to starboard, as if on a pivot, with amazing rapidity, and so increase rather than diminish the distance between her and danger.

GARDNER'S PATENT LIFE-SAVING APPLIANCES.

[*The Steamship.*]

A public exhibition of Gardner's patent life-saving appliances took place on the Thames in front of the Houses of Parliament, on the 14th December, and was witnessed by a number of Members of Parliament, representatives from the Admiralty, and other gentlemen interested in shipping matters. These life-saving appliances consist of Gardner's patent unsinkable lifeboat and ships' safe, and Garner's patent ships' davits.

The lifeboat, which is 22 ft. long, is made externally in the form of an ordinary lifeboat, and is entirely decked over. In the deck are eight circular apertures about 20 in. in diameter, through which project the bodies of the men who work the boat. It is constructed to carry twenty-four men—sixteen sitting inside, and eight using the oars. Suitable water-tight canvas covers are provided for the apertures, which can be closed, and the whole crew go below if required. The lifeboat, or "safe," as the inventor prefers to call it, is so constructed that it will neither sink nor capsize. Tanks are provided for water, provisions and valuables. A coil of rope can be delivered from the boat if required; and a small oil tank is provided fore and aft to calm the sea in broken water. The boat is self-righting, and if capsized instantly assumes its proper position. A small hand pump is fitted to take out any water which may lodge in the bottom, and water valves are provided, so placed that the water can never rise in the boat to a dangerous height, as it is self-emptying. Air valves and fittings for giving light below are provided. Mast, sail, rudder and oars are also fitted as in an ordinary boat.

The patent ships' davits are an entirely novel arrangement for launching ships' boats, by means of which the usual davits, blocks and tackle are dispensed with. The boat is slung from projecting arms, which are fitted to a movable frame. The whole frame, with the boat slung up, can be moved back or forward, so as to bring the boat inboard or sling it clear of the ship's side. The raising of the boat is done by small winches, and the frame is moved by similar means. The whole crew can get into the boat and lower themselves into the water, ropes attached to brakes on the winches being provided for this purpose. In the exhibition the davits were fixed on a lighter, and were full-sized davits, carrying a 14-ft. lifeboat.

The following is a complete programme of the exhibition:

1. The crew of 24 men will man the boat, 16 sitting inside, and 8 standing in waterproof jackets will use the oars in rowing the boat,
2. The crew will show how the rope leaves the boat, which gives a communication from the wrecked ship to the shore.
3. The crew will demonstrate how all hands can go underneath in a storm, except the man on watch.
4. The boat will be turned upside down every five minutes from 2 until 4 P. M.
5. The crew of 4 or 6 men will show how the boat can be lowered on to the water by the handles on davits.
6. The crew will show how the boat can be lowered by brakes from the platform on davits.

7. The crew will show how all hands can leave the ship at once, and lower themselves on the water.

8. The crew will show how long it takes to lower the boat and pick up a man that has fallen overboard.

The various experiments were gone through without a hitch, and the apparatus worked very satisfactorily. The boat was capsized and turned right over by means of a crane, and in every case righted herself instantly. The time taken to lower the boat by means of the patent davits was under 10 seconds; to lower and raise the boat, with the crew in, took 47 seconds; and to lower the boat, pick up a man in the water, and return to the ship and raise the boat into position by the patent davits took 45 seconds.

The whole experiments were a complete success, and the apparatus is worthy of the attention of shipping companies and all who are interested in the very important question of providing efficient life-saving apparatus on board ship.

The inventor is Mr. Cuthbert Gardner, Rosebery House, Redcar, who will furnish further information.

BRITISH ARMOR AND ORDNANCE.

[*Engineer.*]

Our authorities tell us, not in answer to questions, but spontaneously, that at the present moment England is taking the lead both in armor and ordnance. It is some years since such a statement was made, and we need to test the grounds before we allow ourselves to accept so pleasant a conclusion. Lord Spencer has at all events one definite feature to point to, namely, the manufacture of wire or riband guns for the service, in which at present England stands alone. The 12-in. wire gun, fired as it is with cordite, is a very remarkable weapon, and we are glad to hear that a few made in the Arsenal are nearly ready for service, one having undergone proof. This gun we do not here dwell on, for it deserves more special notice than can be here given to it. Smaller calibres of wire guns are naturally being pushed forward also. While, then, we are unwilling to pass by the question of our guns without some reference, our immediate object is with armor as discussed at the Institution of Naval Architects, on Thursday, March 15. Mr. White on this occasion made the statement referred to above that for the moment, at all events, England is ahead of other powers in the matter of armor. This statement may surprise some of our readers, seeing that we have recently imported the manufacture of armor on the Harvey system from America, and having done so, we have failed to convince Austria and Holland that it is better than continental untreated plates. It is desirable, then, to examine the ground on which Mr. White bases his statement. It is possible that he may have referred to the Continent rather than America, because he elsewhere pointed out that England was the first European power that had adopted Harveyed armor, and so the general statement that England was now leading, although unqualified, may have been intended to refer only to Europe. At all events we may examine what grounds there are for claiming a lead, first as compared with the Continent, and then as to the United States. The superiority of steel armor test plates treated on the Harvey system, to the untreated plates preceding them, has been so abundantly established in this country that, in speaking of the question on its own merits, without any thought of comparison with continental armor, the only doubt is whether to credit the improvement as having amounted to 50 per cent. or some much higher figure. Both untreated and treated steel plates on the Continent have also improved to a surprising extent, but so far as actual resisting powers are

concerned, we should concur with Mr. White in giving the preference to Harveyed plates. Krupp's treated plates have in some instances closely resembled those subjected to the Harvey process, but the last one tested at Pola was unfortunate, and without saying that Krupp will not equal or beat us on some future occasion, at the present moment we think that the plates he has submitted for public trial have not established a record that can be considered equal to the very extensive one now achieved by English-made Harvey plates in England and on the Continent. That Schneider and Witkowitz untreated plates have on occasion shown extraordinary powers does not, in our judgment, prevent the conclusion being arrived at that the hard face of a treated plate, on which the best projectiles break when striking directly, and still more readily obliquely, offers advantages which no untreated plate can claim, and of treated plates the Harvey undoubtedly stands first at the present time.

The question on which most light was thrown incidentally by the facts which came out in discussion is the comparison of English Harveyed plates with those of the United States. Both in the use of nickel and in the Harvey process the UnitedStates were in the field before us. They tested their Harvey plates with 8-in. Holtzer steel shot; while we were attacking our compound plates, treated by the Tresidder process, with 6-in. shot only. Their plate trials have been in the very front as to progress. Last year they tested magnificent nickel steel plates with Carpenter projectiles made in America, which put to shame the Holtzer shot fired on the same day, although the latter were of smaller calibre, and therefore easier to manufacture. It needs, then, very clear evidence to establish a claim for superiority as compared with the United States, even for the moment. We think, however, that the following points may be urged, although we speak doubtfully. Since the introduction of the Harvey process in England, we have increased the severity of the tests; in fact, discovering what could be learned by repeatedly testing plates to destruction, and investigation has led to the conclusion that Harveyed steel plates, without any nickel in their composition, are slightly superior to those containing nickel, their resisting power to penetration being greater, although their toughness is less. In the United States nickel is used in all plates, but it is doubted whether thick plates can with advantage be subjected to the Harvey process. Without giving a distinct reason, the makers seem reluctant to subject their thick plates to the prolonged high temperature which is needed, urging generally how undesirable it is to do so unless the gain is very great; while they point out that the good effect of water hardening and carbonization is necessarily limited to a depth which tells much less on thick than on thin plates. In addition to this we have heard that trouble is caused in America by the difficulty of drilling holes in the faces of their hard plates. In the discussion which followed the reading of his paper, Mr. Ellis stated two facts bearing on this: One that the presence of nickel causes steel to crystallise at a much lower temperature than it would otherwise, and the other that the "arc light" system of drilling is not applicable to plates containing a high percentage of carbon and nickel together. It seems, then, a natural conjecture that the nickel in the United States plates has given trouble both in the Harvey process and the process of drilling, which trouble we have happily avoided owing to the decision to dispense with its use. If this is so we shall find that the United States soon follow our example, and we may in the meantime be said to have the lead that Mr. White claims; although we acknowledge that whatever may be the dislike to apply the Harvey process to thick armor, extraordinary results have in one instance been achieved by a United States Harvey plate 14 in. thick. We also have to admit that the remarkable series of successes achieved by the Harveyed plates, conclusive as they are as to firing for experiment, have as yet not convinced the continental powers that they ought to adopt them, because the process causes the plates to bend and alter slightly in form, and they are

not satisfied that this can be so calculated and allowed for, or so controlled as to admit of armor being fitted properly to the form of the ship's side. The answer was given to this objection that the U. S. ship Maine had been completed with her supply of Harveyed plates, that our own makers have now succeeded in making plates to a given curve, and that no serious difficulty is anticipated. We hope, then, altogether that at the present moment we stand in a very favorable position to furnish the new ships to be laid down with the best armor, and we trust soon to be able to give our readers detailed evidence with regard to our guns.

U. S. S. INDIANA.

The indications are that the battleship Indiana will procure a premium for her builders, the Wm. Cramp & Sons' Ship and Engine Building Company, of $100,000, which will mean that she will make an average run of sixteen knots an hour, which will be one knot in excess of her guaranteed speed.

Her contractors' speed trial is thus described by the daily press:

After passing outside the Capes her course was changed, and she ran to the northward. The day was a perfect one for a sea trial. The course over which her trial runs were made was off Cape May, and was between the Southwest Lightship, at the Five-Fathom Bank, to the Northeast Lightship, 9.65 nautical miles up the coast.

The ship was put over this course six times—three times in each direction. The turns were made at full speed, and the ship was practically under five hours' continuous steaming at high speed. During all this time there was no accident of any kind to the machinery or the ship; not a bearing became unduly heated and everything worked so smoothly that even her builders were surprised.

The first runs were made with natural draft. The averages were 14.02 and 14.12 knots respectively. The engines averaged 122 revolutions, and as practically the same time was made going and returning the tidal effect was practically eliminated.

A moderate forced draft of half an inch air pressure was used for the next runs and an average of fifteen knots was maintained over this course. This is the speed called for in the contract with the Government. The last two runs were made under a forced draught of one inch air pressure. This increased the average revolutions to 125, and a maximum of 128 was reached at one time.

Only a slight vibration from engines or screws could be felt. A bow wave was pushed up until it covered the forward torpedo-tube with spray, but instead of diverging at a wide angle, as was the case when the Columbia or the New York were speeded, it curved inboard and followed the lines of the ship. The ship made 15.6 knots on these last two runs.

The Indiana is the first of the three coast-line battleships and was authorized by act of Congress, approved June 30, 1890, appropriating for the construction of three battleships at a cost not exceeding $4,000,000 each. Bids were opened October 1, 1890, and on November 19, 1890, contracts were awarded to the William Cramp & Sons' Ship and Engine Building Company, of Philadelphia, for two of these vessels at a contract price of $3,020,000 each, to be finished within exactly three years.

The hull will be protected by belts of heavy armor, eighteen inches thick at the maximum and seven and one-half feet wide, three feet of which is above water. This protection is to run along both sides of the vessel for a distance of 148 feet amidships, at the extremities of which the armor will turn in toward the center line at an angle of forty-five degrees for the longitudinal

distance of twenty-four feet, affording a total broadside protection of 196 feet, and passing around and supporting the armor for the 13-in. gun turrets.

On top of this side armor is placed a steel deck, two and three-fourth inches thick, under which are the magazines and machinery. Above this belt of side armor and extending from redoubt to redoubt there is armor five inches thick, with a backing of ten feet of coal.

The vessel is cut up forward beneath the waterline, making a powerful ram bow. The easier lines so obtained diminish the bow wave and also add to the maneuvering qualities.

The principal dimensions are:

Length on the waterline, feet	348
Breadth, extreme, feet	69.25
Draught, forward and aft, feet	24
Displacement, tons	10,200
Sustained sea speed, knots (guaranteed)	15
Normal coal supply, tons	400

Between the turrets for the 13-inch guns there is a superstructure in which are placed the 6-inch guns, and above, or upon the deck erected thereon, are placed the 8-inch guns. A battery of 6-pounders is arranged along the top of the hammock berthing and bridge, and 1-pounders are placed two forward and two aft, one on either side, on the berth deck. In the tops of the double-topped military mast are placed four Gatling guns, two in each top.

The main battery will consist of four 13-inch, eight 8-inch and four 6-inch breech-loading rifles. The secondary battery will contain twenty 6-pounder and four 1-pounder rapid-fire guns and four Gatling guns.

There are six torpedo tubes—one bow, one stern and four broadside—two on each side, just abaft and forward of the forward and after barbettes respectively.

The four 13-inch guns are mounted in pairs in two barbette turrrets forward and abaft the superstructure on the main deck. The lower part of these turrets, or barbette, has armor seventeen inches thick, while the armor of the turret proper, that rises above the barbette, is fifteen inches thick.

The 8-inch guns are mounted in pairs in four turrets of similar character, two on either side, on the forward and after extremities of the superstructure deck. The armor of the 8-inch gun turrets in six inches thick.

The four 6-inch guns, two on each side, are placed amidships on the main deck. The guns will have local protection in addition to splinter bulkheads, shields and automatic shutters.

The 13-inch guns have an effective arc of fire of 270 degrees. The guns are mounted about seventeen feet above the waterline. The 8-inch guns are about twenty-five feet above the waterline and are high enough to fire over the 13-inch turrets. These guns have an arc of action of 164 degrees.

The engines are of the twin screw, vertical, triple-expansion, inverted cylinder type, the diameter of the cylinders being as follows: High pressure, 34½ inches; intermediate pressure, 48 inches; low pressure, 75 inches, with a common stroke of 42 inches. There are four double-ended boilers 18 feet long by 15 feet in diameter and two single-ended boilers (donkey) 8½ feet long by 10 feet in diameter. Each boiler and engine is in a separate water-tight compartment, in order to localize possible injury.

While the normal coal supply is 400 tons, there is a coal bunker capacity of 1800 tons.

The complement will consist of 460 officers and men.

The accompanying table will give a fair idea of the fighting value of the Indiana as compared with six of the latest battleships of other powers:

Details.	Indiana (U. S.).	Royal Sovereign (British).	Centurion (British).	Massena (French).	Sicilia (Italian).	Brandenburg (German).	George Pobledonosets (Russian).
Date of launch	1892	1891	1891	Building.	1891	1891	1891
Length on load-line (ft.)	348	380	360	363.5	400	354.33	320
Extreme breadth (ft.)	69.25	75	70	65.5	76.75	64	69
Mean draught (ft.)	24	27.5	25.5	26.25	28 5	24.58	26.58
Displacement (tons)	10,200	14,150	10,500	11,700	13,298	10,300	10,280
Maximum indicated horse-power	9,000	13,000	13,000	12,600	19,500	9,500	15,000
Maximum speed (knots)	16.25	17.5	18	18	18	16	16
Normal coal capacity (tons)	400	900	750	585	1,200	(?)	700
Radius of action at 10 knots (sea miles)	3,550	5,000	5,000 (?)	4,000	(?)	(?)	(?)
Maximum thickness of armor (inches) — turrets	17	17	9	15	18	11.75	12
Maximum thickness of armor (inches) — belt	18	18	12	17.75	4	15.75	16
Armament	4 13-in. B. L. R., 8 8-in. B. L. R., 4 6-in. B. L. R., 20 6-pdr. Q. F., 4 1-pdr. Q. F., 4 Gatlings.	4 13.5-in. B. L. R., 10 6-in. Q. F., 26 small Q. F., 8 machine-guns.	4 10-in. B. L. R., 10 4.7-in. Q. F., 8 6-pdr. Q. F., 12 3-pdr. Q. F., 7 machine-guns.	2 11.8 in. B. L. R., 2 10-5 in. B. L. R., 8 5.5-in. Q. F., 8 4-in. Q. F., ... 12 3-pdr. Q. F. 20 1-pdr. Q. F.	4 15.5-in. B. L. R., 8 6-in. Q. F., 16 4.7-in. Q. F., 27 small Q. F., 2 machine-guns.	6 11-in. B. L. R., 6 4-in. Q. F., 8 3.4-in. Q. F., A number of small rapid fire and machine guns.	6 12-in. B. L. R., 7 6-in. Q. F., 8 4-in. Q. F., 6 machine-guns.
Torpedo-tubes	6	7	7	4	5	7	7

TRIAL TRIP OF H. M. S. HORNET.

The official trial of H. M. S. Hornet, built by Messrs. Yarrow & Co., took place in the estuary of the Thames on Monday last, in the presence of Mr. Durston, engineer-in-chief, Mr. Pledge, and Mr. Harding, representing the Admiralty, Mr. Carnt for Portsmouth Dockyard, and Mr. Coad. The following is a copy of the results as recorded :

MARCH 19, 1894.—PROPELLERS, 6 FT. 4 IN. IN DIAMETER ; CALM WEATHER AND HIGH WATER.

Time of Day.	Steam in Boilers.	Vacuum.	Air Pressure.	Revolutions. Starboard.	Revolutions. Port.	Time.	Speed.	Means.	Second Means.	
						min. sec.				
10.28	170 lbs. mean.	26 in.	Averaged 1¼ in.	395.9	395.4	2 17.6	26.163			
								27.322		
10.34				384.4	386.8	2 6.4	28.481		27.370	
								27.418		
10.43				384.7	392.2	2 16.6	26 355		27.395	27.313
								27.373		
10.52				391.3	392.7	2 6.8	28.391		27.306	
								27.239		
11.2				380.0	381.7	2 18	26.087		27.183	
								27.128		
11.10				394.3	394.3	2 7.8	28.169			

The three hours' trial commenced at the Chapman Lighthouse and ended below the Sunk Lightship. The average speed for the whole time was found to be 27.628 knots per hour.

After this circles at full speed were turned to starboard and port, and generally all the usual tests of machinery and ship were made, all of which were found to be perfectly satisfactory. At full speed and at slower speeds practically to vibration was felt. There was no heating of any parts of the engines, and the boilers made ample steam with a mean air pressure of 1.5 in. The Admiralty authorities expressed themselves highly pleased with the result in every respect.

We have already described the Hornet, her most important feature of novelty being the adoption of the Yarrow type of water-tube boiler, of which there are eight in number. The Havock, whose trial took place the latter part of last year, in exactly similar vessel, and provided with engines of the same design. The Havock, however, has the locomotive type of boiler, two being fitted. The difference in the results obtained in two vessels proves the superiority, in point of securing a high speed, of the Yarrow water-tube boiler over the locomotive boiler. A comparison between the results of the Havock and the Hornet shows that in the former vessel on the official trial approximately 3500 horse-power was indicated, while in the case of the Hornet 4000 horse-power, which, approximately, is in direct proportion to the cubes of the speeds of the two boats, the consumption of fuel also being in direct proportion to the powers indicated. The air pressure in the stokeholds of the Havock was about 3 in., and in the Hornet 1½ in.

We understand that a number of destroyers, now building for the British Admiralty by various firms, are being fitted with Yarrow's water-tube boilers.

THE JULES DAVOUST.

An aluminum boat, the Jules Davoust, which has been sent out to the Niger by the French Government for hydrographical purposes, is reported to be an entirely successful experiment. It weighs about 4400 pounds and has a capacity of 11 tons, with a draft of about 15 inches. It is about 40 feet long, 6 feet wide, and 2½ feet deep. There are three masts and a deck cabin, as well as a movable deck-tent, or pavilon. The sails are of the lateen order and easily managed. Two Hotchkiss quick firing guns are mounted amidships. The vessel was built by Lefebvre, of Paris, who has already furnished several dismountable vehicles of this metal for the use of the French troops in the Soudan and Tonquin. The lightness of the material makes it valuable for such uses in wild and unexplored countries, as boats or vehicles made of it can be easily carried through the bush. Word comes, also, from France of the use of aluminum for cabs in Paris, where the company L'Urbaine, who own the largest number of hacks in the French capital, are about to use the metal in their construction. The company are now using tin plate for the bodies of their cabs. It is reckoned that an ordinary coupé weighs about 1000 pounds. This weight, it is expected, will be greatly reduced if it is found that the aluminum cabs are a practical success.

BOOK NOTICES.

THE PRATT AND WHITNEY COMPANY IMPROVED GARDNER MACHINE GUN. FEBRUARY, 1894 (FOR PRIVATE CIRCULATION).

The original Gardner Gun was invented in 1874, since which time the Pratt and Whitney Company has perfected it with the ambition of making it the foremost small ammunition weapon of the period, and with considerable success. The present system positively carries the cartridge to its place and retains the shell in position until it is ejected. The recent introduction of a shell starter, which has a positive movement and will, in all cases, remove the shell or cut through its head, has strengthened the only weak point developed on trial, and has, it is claimed, made the gun worthy of confidence in all respects. The improved gun possesses lightness, strength, simplicity, durability of working parts, and can be adapted to firing one or more than one barrel at will. It can be arranged for any caliber up to one inch. The gun certainly commends itself to critical examination and test.

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AMERICAN ENGINEER AND RAILROAD JOURNAL.

JANUARY, 1894. Notes on the Machinery of the New Vessels of the United States Navy. Method of Manufacturing Weldless Chains. Armored Cruiser New York. Progress in Flying Machines (concluded). Driggs-Schroeder Rapid-Fire Guns.

FEBRUARY. Buffington-Crozier Disappearing Gun Carriage. Apparatus for Rapid Loading of Coal into Ships. Projectile Trimming Machine. First-Class Battleship Royal Oak. Riveting Pressures Required for Boiler and Bridge Work.

MARCH. The Battleship Texas. Apparatus for Rapid Loading of Coal into Ships (continued). The Scientific Uses of Liquid Air.

APRIL. Turret and Turret-Moving Machinery of the Battleship Texas. Iron and Steel Wire.

MAY. Water-Tube Boilers. The Reciprocating Parts of a Locomotive. Boilers and Feed-Pumps of the Battleship Texas. The Ram in Action and in Accident. Steam Steering Gear. Testing Machines. Steam Life-Boats. H. S. K.

CASSIERS' MAGAZINE.

MAY, 1894. Consolidating Steel Ingots. Some Heavy Modern Pumping Machinery. Wrought-Iron Tube Making. How Electricity is measured. H. S. K.

ENGINEERING NEWS AND AMERICAN RAILWAY JOURNAL.

VOLUME XXXI., No. 13, MARCH 22, 1894. The Electrical Purification of Water. Rustless Coatings of Iron.

APRIL 19. Approximate Cost of Surveys, etc., of the U. S. Coast Survey. Testing Machines and Tests of Materials.

IRON AGE.

VOLUME LIII., No. 11, MARCH 15, 1894. Trial of the United States Battleship Indiana (Contractor's).

MARCH 22. Oil Fuel in Ocean Steamers. The Cowper-Coles Cold Galvanizing Process.

This process is said to be especially suitable for coating the plates of the hulls of fast vessels.

Tests of Aluminum Boats. Uniformity in Testing. The British Dockyard at Bermuda. The Marine Boiler Steel Test. The Rusting of Iron and Steel. Forging by Hydraulic Pressure. Aluminum Yachts. New Magazine Rifle for the Navy.

MARCH 29. Iron and Steel in Shipbuilding. Tube Sheets and Tubes of Boilers of War Ships.

APRIL 5. Test of 12-Inch Projectiles (at Sandy Hook). The First American Steel Sailing Ship. Winding Steam Main Pipes. The British Naval Programme.

APRIL 12. Drilling Nickel Steel Armor Plate. Blow Holes in Armor Steel.

APRIL 19. New Type of Vertical Compound Engine. Leonard Smokeless Powder.

Very gratifying results as regards its uniformity and energy were obtained on Saturday, April 14, with the American Leonard smokeless powder. It was tested at the Naval Proving Grounds at Indian Head, in a 4-inch naval rapid-fire gun, with a 33-pound projectile, in the presence of the chief of naval ordnance and a board of experts. A 5-pound charge of the powder yielded 1764 feet muzzle velocity with but 6 tons of chamber pressure per square inch; a 7-pound charge yielded 2054 feet muzzle velocity with 8 tons pressure; a 9-pound charge yielded 2299 feet velocity with 9½ tons pressure; an 11-pound charge gave 2537 feet velocity with 14 tons pressure; and a 12-pound charge gave 2736 feet muzzle velocity with only 17⅞ tons of chamber pressure.

Science in Steel Manufacture. The Card Index. Finished Iron and Steel in Great Britain. Open-Hearth Steel in Great Britain.

APRIL 26. The Olsen Testing Machines. Rusting of Iron. The King Chain Hoist. The Coal Production of the United States.

JOURNAL OF THE ASSOCIATION OF ENGINEERING SOCIETIES.

VOLUME XIII., No. 1, JANUARY, 1894. A New Prismatic Stadia.

JOURNAL OF THE UNITED STATES ARTILLERY.

VOLUME III., No. 2, APRIL, 1894. Coast Artillery Fire Instruction.

Fourteen officers of the artillery and one of the corps of engineers contributed papers upon this important subject in response to a circular letter soliciting discussion. The following synopsis indicates the scope and object of the discussion.

A. The selection and preparatory instruction of the Artillery soldier.

I. The elementary instruction of the recruit.

II. The organization, equipment, and instruction of the detachment, platoon and battery.

B. The fundamental fire-instruction of the Artillery personnel.

I. The first period of Coast-Artillery fire instruction.—*Ballistic-Firing.*

A. The determination and reduction of fundamental ballistic data. *a.* Operations involved in obtaining these data and considerations relating thereto. *b.* Range tables. *c.* Methods of obtaining the values of all deviating causes affecting the trajectory, such as jump, atmospheric conditions, drift, etc., and their correction in practice. *d.* Probabilities, deviations, etc. *e.* Fire game. *f.* Where and how should this instruction be given?

II. The second period of Coast-Artillery fire instruction.—*Target-Firing.*

A. Present conditions and methods and their improvement. *a.* The present allowance of ammunition and the best means of using it. *b.* The old guns and their value as instruments of instruction. *c.* Present auxiliary apparatus, such as plotting boards and observation instruments. *d.* Auxiliary methods of checking results. *e.* What is the best method of measuring lateral deviation of shots, by transit alone or by co-operation with station observers; the best means of plotting shots, with respect to range of target or with respect to range corresponding to elevation given? *f.* The value of sub-caliber practice. *g.* Best methods of conducting target practice. *h.* Suitable ranges. *i.* Range finding. *j.* Kinds of targets. *k.* Moving targets.

B. Powder. *a.* Desirability and practicability of manipulating the powder in any way at the beginning of a target season. *b.* Practical use to be made of laboratory data with respect to moisture, density, etc.

C. Conditions of loading. *a.* Importance of noting the density of loading. *b.* How can this be done, especially in the 15-inch S. B. gun?

D. Records. *a.* What records should be kept? *b.* How can they be utilized with view to drawing from them the maximum amount of instruction?

III. The third period of Coast-Artillery fire instruction.—*Tactical-Firing.*

A. Considerations relative to the fire of the guns of a battery. *a.* Fire discipline and control. *b.* Concentration. *c.* Rate.

B. The fire relation of one battery to another.

C. The fire relation of a group of batteries to another group of batteries.

The purpose of the discussion is to include questions relating to Artillery fire instruction from the elementary instruction of the recruit to the duties and responsibilities of the Artillery Commander.

Coast Artillery Practice (Royal United Service Institution). The Attack of a Coast Fortress (Duncan Gold Medal Prize Essay, Royal Artillery Service Institution, 1893). The Attack of a Coast Fortress (Silver Medal Prize Essay, Royal Artillery Institution, 1893).

JOURNAL OF THE FRANKLIN INSTITUTE.

MARCH, 1894. The Manchester Ship Canal and its Moral. The Theory and Design of the Closed Coil Constant Current Dynamo. The Resistance of Ships.

APRIL. The Edson Pressure Recording Gauge. On the Maximum Contemporary Economy of the High-Pressure Multiple-Expansion Steam Engine. The Resistance of Ships (concluded).

MAY. The Electric Motor. Engineering Practice and Education.

H. S. K.

JOURNAL OF THE MILITARY SERVICE INSTITUTION.

MAY, 1894. Coast Defense. A South American Revolution (in Chili). Transport of Troops and Supplies. The Military Hand-Litter. Musketry Experimental Firing. A General View of Existing Artillery. H. S. K.

PROCEEDINGS OF THE AMERICAN ACADEMY OF ARTS AND SCIENCES.

NEW SERIES, VOLUME XX. On the Thermo-Electric Method of Studying Cylinder Condensation. Note on an Approximate Trigonometric Expression for the Fluctuations of Steam Temperature in an Engine Cylinder. H. S. K.

FOREIGN.

ANNALEN DER HYDROGRAPHIE UND MARITIMEN METEOROLOGIE.

VOLUME XXII., No, 2. 1894. Meteorological and Hydrographic Conditions of the Steamer Route from Sydney to the Tonga and Samoan Islands (conclusion). On the Origin of Ex-Tropical Cyclones. Beaufort's Scale of Force of Wind Reduced to Metrical System. A Mathematical Expression for the Resistance in Aërial Motion. The Winds of the Indian Ocean. Notes on Some of the Marshall and Caroline Islands. Notices:—1. Winter Thunder Storms and St. Elmo's Fire in North-Western Germany; 2. Gales of the 16th to 20th November, 1893; St. Elmo's Fires and Lightning Rods.

The Weather Report of January, 1894, for Coast of Germany.

No. 3. Report of German Naval Observatoy on Magnetic Observations made in 1893, on German Coast. The Heavy Gales of February 7 to 12, 1894. Experiments to Illustrate the Rebounding of the Trade Winds from the Surface of the Atlantic Ocean. Effects on Depths of Sea of Dumpings outside of Rotterdam. On Ground and Surface Ice. A New Work on Ships' Chronometers.

Remarks on E. Caspari's Book on Chronometers.

The Harbors of Santos, and Tocopilla. Minor Notices:—Lead Poisoning on Board Ship. H. G. D.

BOLETIN DEL CENTRO NAVAL.

VOLUME XI., OCTOBER AND NOVEMBER, 1893. Brief Historic Points upon Modern Naval Warfare (continued). Breaking out of Hostilities in the Black Sea. First Military and Naval Operations. Report on the Voyage of the Cruiser 9th of July, from Newcastle

on the Tyne to Buenos Ayres. Report upon the Torpedo Station of the La Plata. Naval Manœuvres of the Chilian Fleet in 1893. Attack of Torpedo-Boats on the Port of Caldera, August, 1893.

S. L. G.

DEUTSCHE HEERES-ZEITUNG.

19TH YEAR, No. 18, MARCH 3, 1894. Suicides in the Prussian Army. Review of Russian Military Matters.

MARCH 7. Continued Trials with the Lebel Gun.

These trials were made against brick walls, and iron and steel plates to test the penetration of the Lebel bullet.

Launch of the French Cruiser Linois. Russian Military Matters (continued).

Nos. 20, 21. Review of Russian Military Matters (continued). Reorganization of the Italian Naval Academy.

MARCH 17. Employment of Algerian Tirailleurs in a European War. Launch of the Torpedo Destroyer Decoy.

MARCH 21. The Network of Russian Railroads. Assignment into Groups of the French Fortifications. Firing Practice in Russia with Eighty Field Pieces. New French Navy List.

MARCH 28. Modern Military Rifles; Comparing the Ballistics of the 11, 8, and 6.5-Millimeter Rifles.

The caliber of the new Russian rifle is 7.6 mm.; it differs somewhat in mechanism from the German gun; the initial velocity and danger spaces are the same. Describes also the latest French Dandeteau rifle of 6.5 mm. caliber, with initial velocity of 750 meters per second.

Launch of the Hazard.

APRIL 7. Reforms in Uniforms, Equipments and Arming of the Infantry. The Coming Field Piece.

APRIL 11. The Coming Field Piece (concluded). Regulations for French Coast Defense.

APRIL 14. Armor in Land Fortifications.

APRIL 25. The Construction of the Projectile the Principal Factor in the Weapon of the Future, by Professor Spohr.

APRIL 28. The Construction of the Projectile the Principal Factor in the Weapon of the Future (continued). Launch of the Halcyon.

MAY 2. Cloth Targets (illustrated). H. G. D.

ENGINEER.

VOLUME LXXVII., No. 1994, MARCH 16, 1894. Institution of Naval Architects. The Making of a Modern Fleet. (An abstract from a paper by Mr. W. H. White, C. B., etc.) Editorial: Boilers for Torpedo-Catchers. Launches and Trial Trips.

MARCH 23. Carnot and Modern Heat (continued). The Institution of Naval Architects. Editorial: The New Naval Programme; British Armor and Ordnance; Cordite. Engines of H. M. S. Theseus and Royal Arthur. French High-Velocity Trial.

The following remarkable results in high velocity were obtained early last summer in France, but have escaped notice, so far as we know, in this country. It may be seen that the experiment is a repetition on a rather larger scale of that carried out at Elswick. It is, however, interesting, as the velocity obtained is considerably higher. The figures we quote from the French journal *l'Amérique*, but we have also obtained the general facts from other sources.

At the Arsenal of Rochfort a 16-cm. (6.3 in.) gun was made up to the extraordinary length of 16 m. (52.5 ft.) by screwing additional tubes to the muzzle so as to make it up to 90 calibres in length. With a projectile of 45 kilos. (99.2 lbs.) weight, the unprecedented muzzle velocity of 1214 m. per second (3983 foot-seconds) was obtained. It will be clearly understood that this is not a service piece like the 10-cm. gun of Canet, which is 80 calibres long. We only mention it on account of the extraordinary velocity actually achieved. Both with regard to questions affecting flight and also perforation of armor, high velocity has an interest of a scientific kind.

Our Water-Tube Boilers. Launches and Trial Trips.

MARCH 30. The Institution of Naval Architects. Editorial: The Navy Estimates; The Movement in Shipbuilding. Electric Signals for Warships.

APRIL 6. Carnot and Modern Heat (continued). The Institution of Naval Architects. Canet's Central-Pivot Quick-Firing Gun Carriage. Editorial: Liquid Fuel at Sea; Engineers in the Navy. The United States Defense Ram Katahdin. Launches and Trial Trips.

APRIL 13. The Panama Canal as it is (illustrated). Editorial: Doctored Armor-Plates in America. Launch of H. M. S. Halcyon. Launches and Trial Trips.

APRIL 20. Carnot and Modern Heat. Some Destructive Effects of Projectiles (from small-arms). Closed-in Berths for Shipbuilding.

APRIL 27. Shipbuilding on the Longitudinal and Flanged-Girder System. Editorial: The Re-Armament of our Early Ironclads.

APRIL 28. The Iron and Steel Institute. Editorial: The Cost of Electrical Energy. A New Type of Electric Crane. Launches and Trial Trips.

ENGINEERING.

VOLUME LVII., No. 1472, MARCH 16, 1894. Some Electrical Phenomena. Armstrong Quick-Firing Guns. Editorial: The Gunnery Trials of H. M. S. Barfleur; The Making of a Modern Fleet. The Institution of Naval Architects. French Shipbuilding Bounties. The Qualities and Performances of Recent First-Class Battleships, by Dr. W. H. White, Director of Naval Construction.

The discussion of Dr. White's paper was the chief event at the meeting of the Institution of Naval Architects.

It had been looked forward to with considerable interest; but the discussion hardly rose to the pitch of importance that had been anticipated. The result, on the whole, was, however, satisfactory, inasmuch as the facts brought forward by the naval officers who spoke, and the tone of the discussion, tended to show that the most important vessels constructed under the Naval Defense Act, the Royal Sovereign class, were looked upon as magnificent fighting ships, and if the Resolution did roll in a most unpleasant manner, as she undoubtedly did, such an occurence was not a new feature in ship design, but was common to older vessels which undoubtedly possess the confidence of naval officers. It would be absurd to condemn these splendid ships, which possess a combination of admirable qualities never before equalled, because they do not perform the impossible feat of being free from rolling to great angles of heel under specially adverse conditions, which are likely to occur but seldom. As was said during the discussion, "England may rule the waves, but as long as waves exist naval architects cannot produce ships that will not roll." The most the naval architect can do is to make the periods of excessive rolling as rare as possible, and this can only be effected by reducing the chance of synchronism between the wave period and the natural period of the ship.

MARCH 23. The Institution of Naval Architects. The Navy Estimates. The Parallel Working of Alternators. Notes: Cordite.

The interesting trial between Mr. Nobel and the Government having been the means of definitely settling the question of property in the invention of cordite, it seems probable that makers of explosives will soon be wanted to tender for large quantities of what may now be called the service smokeless powder. The manufacture is a very elegant one, and comparatively free from danger, mainly on account of the absence of dust. The production of nitro-glycerin is, indeed, a highly dangerous process, but freedom from the uncertainty involved in the presence of dust renders the manufacture safe if the proper precautions are rigidly observed. Cordite has now been definitely adapted for the magazine rifle, and to all the quick-firing guns, and charges have also been settled for some of the ordinary service breechloaders, and notably for the splendid new naval 12-in. Longridge gun, which has just been produced in the Royal gun factories. Although cordite has, up to this moment, been used only in the form of round cords varying in diameter from .0375 in. to .7 in., steps are being taken to try other forms, such as square, hexagonal, oblong and tubular. The latter form, which is produced exactly in the same way as lead pipe, was made as early as June, 1889, in small sizes, but is now being pressed out in large diameters. Cordite being of a horny and non-porous nature, burns exclusively on the surface of the cords, and with such regularity

that, when not fully consumed in the gun, it is ejected burned down sometimes as thin as a thread, but yet of uniform thickness. It is obvious, therefore, that the rate of combustion depends upon the relation between the volume and the surface, and that the tubular form offers great facilities for varying this relation without making the cord inconveniently thin. A good deal of misconception exists as to the wear of guns using the new explosive. As far as can be made out up to the present, the erosion due to cordite for the same ballistics is not greater than that produced by the old powders, but the wear is of a different kind. It is confined to a few calibres' length from the chamber, and is more of the nature of a smooth washing away of the metal than of the deep grooving and scoring which black powder produces. Cordite, however, gives much higher ballistics, and on that account it is not to be expected that the wear will be any less, and as the bore is left perfectly clean, the abrasion caused by the friction of the bullet in rifles is necessarily more severe; but still it is found that the wear due to cleaning and periodical lapping out is more destructive under service conditions than the actual firing. One enormous advantage which may be claimed for cordite, besides the absence of smoke, is its indifference to wetting, and safety as regards explosion in magazines and in cartridges unconfined in the chambers of guns.

The Thornycroft Water-Tube Boiler, by Mr. J. I. Thornycroft. Fulgurite, a New Explosive. The Vibrations of Steamers.

MARCH 30. The Institution of Naval Architects; a paper on "Ship-Shaped Stream Forms," prepared by Naval Constructor D. W. Taylor, U. S. N., was read before the meeting.

The author discussed the flow of water from a "source" to a "sink," and gave formulæ by which the pressure and velocity of the water at any point could be calculated for a given speed, illustrating the subject by means of diagrams. He determined stream forms of any desired proportion in fulness, and discussed a method for determining the velocity past and the pressure upon those forms for a given velocity of stream.

In the discussion which followed the reading of the paper, Professor Cotterill was the first speaker. He gave an account of the work done by Rankine in this field, and the position in which he had left the subject. Mr. Taylor had gone farther than Rankine, and had taken a perfectly legitimate step in advance.

Mr. Froude, in replying for the author, said that the difficulty of grasping the meaning of the paper had been referred to. He would remind his audience that the stream-line theory had occupied some of the greatest minds of the age for very many years in its discovery, and it was therefore hardly to be wondered at that its philosophy could not be grasped in ten minutes.

Editorial: The Debate on the Navy Estimates.

APRIL 6. Working Alternators in Parallel. Telegraphic Communication by Induction, by Means of Coils.

A number of experiments were made in the laboratory to discover the laws of the action of coils on each other, with the view of calculating the number of wires, the diameter of coils, the number of ampères, and the resistance of the coils that would be necessary; and, after a careful investigation, it was evident that a gap of 800 yards could, with certainty, be

bridged by a current of one ampère with coils of nine turns of Post Office wire in each coil, the coils being 200 yards in diameter, and with two good telephones on the hearing coil.

Induction from adjacent telegraph lines will often interfere, the messages on the lines being easily read.

Recent Experiments in Armor, by Mr. C. E. Ellis, Managing Director of Messrs. John Brown & Co., Limited.

APRIL 13. Electric Capstans. Steam Dynamo for the Chilean Cruiser Blanco Encalada.

This dynamo is compound wound, coupled direct, and with a speed of 300 revolutions gives an output of 400 ampères at 80 volts.

Editorial: The Navy Estimates. Launches and Trial Trips. Stresses and Strains in the Structure of Vessels.

APRIL 20. The Machinery of H. M. S. Royal Oak. Editorial: The Naval Programme. Working Marine Engines at Reduced Powers. Recent Experiments in Armor (continued). Launches and Trial Trips.

APRIL 27. The Year's Steaming of the Campania and Lucania.

MEAN SPEED ON ROUND VOYAGES.

	Campania, knots.	Lucania, knots.
1.	20.00	20.235
2.	20.275	20.86
3.	21.01	19.42
4.	20.495	20.71
5.	19.885	19.855
6.	20.16	21.285
7.	21.00	
8.	20.215	
9.	19.70	
Mean	20.302	20.394

(These are calculated from the actual distances and times.)

Launches and Trial Trips.

No. 1479. Krupp Ordnance (illustrated). The New Spanish Belted Cruisers (with cuts showing the deck plan and vertical fore and aft section of the cruiser Infanta Maria Teresa). Launches and Trial Trips. Recent Experiments in Armor.

JOURNAL OF THE ROYAL UNITED SERVICE INSTITUTION.

VOLUME XXXVIII., No. 194, APRIL, 1894. The Tactics Best Adapted for Developing the Power of Existing Ships and Weapons (Gun, Ram, and Torpedo), which should Regulate Fleets, Groups, and Single Vessels in Action (Naval Prize Essay), by Commander F. C. D. Sturdee, R. N.

(A review of this admirable essay will form part of the next number of the Proceedings).

The Invasion of France. Naval and Military Notes. H. S. K.

LE YACHT.

FEBRUARY 17, 1894. The Law fixing the List of Naval Officers. "Association Technique Maritime": Results of the Use of Forced Draught in Closed Ashpits.

FEBRUARY 24. New French and English Armored Battleships. "Association Technique Maritime": Some Points Concerning Armor-Plates. The Disaster to the German Battleship Brandenburg.

MARCH 3. The Navy Inquiries. A Cruising Match: From Cape Martin to Genoa and Back. "Association Technique Maritime": Leaks and Centrifugal Pumps. Nautical Qualities of the New Racing Yacht.

MARCH 10. Organization of the Torpedo-Boat Reserve. Extra Parliamentary Naval Board of Investigation. Experiments by M. Mason. River Navigation.

MARCH 17. The Navy. Two Navy Bills. The Board of Inquiry.

MARCH 24. The English Navy Estimates.

MARCH 31. The French Navy Estimates. The English First-Class Torpedo-Catcher Dryad.

APRIL 7. The New Battleships Charlemagne, Saint Louis and Henri IV.

APRIL 14. Naval Estimates. Justifications in France and England. Coast Defense Torpedo-Boats.

The writer foresees that by the year 1900, the squadrons of the first Line will be sufficiently provided with cruisers and scouts to allow of the sea-going and other classes of torpedo-boats being exclusively entrusted with the duties of coast defense. He also condemns the Reserve system as now applied, and recommends frequent runs up and down the coasts in each maritime district, the rendezvous of the torpedo-boat groups being meanwhile efficaciously protected by powerful land batteries.

The French Torpedo-Cruiser Fleuras.

APRIL 21. The National Navy: Next Summer Cruises of our Squadrons. The New Vessels About to Line up and Take the Place of the Obsolete Armored Wooden Vessels. Interesting Tests of Hardened Steel About to Take Place at the Polygone of Gavre.

APRIL 28. The Question of "Dis-Armoring," and the New Armor-Plates. Situation of the Italian Navy, from the Report of Commander Betollo. A New Steam Engine. J. L.

MINUTES OF THE PROCEEDINGS OF THE INSTITUTION OF CIVIL ENGINEERS.

VOLUME CXV. La Guaira Harbor Works. Hamilton Graving Dock, Malta. H. S. K.

MILITÄR-WOCHENBLATT.

No. 19, MARCH 3, 1894. British Gunboats on Lake Nyassa. Criticisms upon the French Fleet.

Calls attention to defects in torpedo-boats, also in the Magenta. The latter's maximum speed is 15 knots. Excessive heeling developed while turning, and when guns are shifted while at anchor.

Russia's Fleet on the Black Sea.

MARCH 7. Pashwitz Telemeter (with illustrations). French Officers in Torpedo Service.

MARCH 20. Shipbuilding in France During the Year 1893. Loss of the Kearsarge. New Bullets for the Lebel Rifle, and New French Ordnance. Lining-Tubes for Heavy Breech-Loaders in Russia. A New Russian Gun.

MARCH 14. Inventions. Launch of the Cruiser Chancy.

MARCH 17. New English Magazine Rifle. French Regulations for Coast Defense. New Spanish Rapid-Fire Gun.

MARCH 24. Lightening of Marching Equipments of the Infantry. Mass Movements of Russian Cavalry.

MARCH 28. Lightening of Marching Equipments of the Infantry (continued). English Army Budget, 1894 to 1895.

MARCH 31. Lightening of Marching Equipments of the Infantry (concluded). Armor Defenses of Metz. Wire Guns in England. Lee-Medford Gun. Armstrong Mounts for Italy.

APRIL 4. Health Conditions in the English Fleet for 1892.

APRIL 7. The 7-Millimeter Mauser Gun, Spanish Model, 1893; Description and Tests.

APRIL 14. English Torpedo Boom. American Submarine Gun Tests.

APRIL 21. Cordite. North Atlantic Squadron of the United States. Austrian Smokeless Powder. Ships Building in Spain.

APRIL 25. A New Combined Compasses and Pocket-Knife for Field Use. Armament for English Auxiliary Cruisers. French Coast Defense.

MAY 2. The Field Piece of the Future. Italian Naval Budget, 1894 to 1895. H. G. D.

SUPPLEMENT TO THE MILITÄR WOCHENBLATT.

No. 4, 1894. The Fleet of the Northern States in the War of the Rebellion, by Captain Stenzel, of the German Army.

A lecture delivered before the Military Society at Berlin, January 10, 1894 (with three maps).

The lecturer dwells on the importance to a state of maintaining a well equipped and thoroughly drilled fleet. In the minds of the intelligent there is no question as to the necessity of a well established army, but opinions have always differed widely relative to the value of a fleet especially as a strategic and military arm of the service. The study of naval strategy was neglected ; in consequence, errors were made such as in 1854 and in 1870; and yet, a living proof was given of the strategic and tactical values of a well managed fleet in the War of the Rebellion.

The lecturer, after describing the field of operations, the relative conditions of the North and South at the outbreak of the war, their relative fighting strengths, enters upon the plan of operations of the North. The blockade receives minute attention, the attacks upon Fort Hatteras, the operations at Port Royal and Mobile Bay are fully described. The operations in the Gulf and on the Western rivers are not neglected. After showing the results of the blockade, the writer sums up by calling attention to the importance of the work rendered by the fleet which practically carried on the war alone, along two fronts of the gigantic field of war. Without its assistance, particularly along the Potomac and James rivers, the army operations would have been futile. Similarly in the West, where the Navy received better co-operation from the Army, the Mississippi was cleared from Cairo to the sea, and the Confederacy cut off on this side. Above all, the blockade of the enormous coast line, maintained for nearly four years so efficiently cut off supplies of all kinds as to cripple and finally bring about the complete exhaustion of the Confederacy.

The results would have been much greater if the services of the fleet had been promptly utilized in an energetic manner by the Northern Government, which failed to recognize immediately its value. Had there been concerted action between the War and the Navy Departments, had the successes of the fleet been promptly followed up by the Army, the war would have been shorter. Not the least was the lack of preparations. The enormous expense, the time consumed, the unavoidable defects in a hurridly mobilized fleet, to which craft of all sorts and descriptions were drawn, is a lesson for the Nation, showing the necessity of maintaining a powerful fleet by a nation with large sea coast, and of being prepared, if only to protect this sea coast against the offensive operations of a maritime power, which recognizes the strategic and tactical importance of its fleet operations.

No. 5. The Battle of Etoges, on February 14, 1814, by Colonel von Sothen.

MITTHEILUNGEN AUS DEM GEBIETE DES SEEWESENS.

Volume XXII., No. 4. Old and Modern Merchant Ships. A Method of Solving the Problem of Double Altitudes. Electric Search Lights in Coast Defense. Intelligence on Foreign Navies. The Catastrophe on the German Battleship Brandenburg. The Russian Battleship Tri Svijatitelja. The New Swedish Armor-Clad Ship of Svea Type (illustrated). The English Torpedo-Gun-Boat Dryad. The Armored Cruiser New York (illustrated). The English Torpedo-Cruiser Havock (illustrated). Naval Notes on the Massachusetts, Indiana and Oregon. Trials of the Heavy Guns of British Battleship Centurion. Gun Drill and Target Practice on English Artillery Schoolships. Boiler Explosion on a French Tor-

pedo-Boat. The German Navy. Cost of the Italian Fleet. French Torpedo Officer's Course. New French Rifle. Loss of the Kearsarge. A New Life Buoy. The Russian Battleship Paris.

No. 5. On Wrecking Operations and Raising of Three Sunken Ships. Trial of a 270-Millimeter Cammel Plate at Pola. The Russian Navy. The Latest French Coast Defense Regulations. The Accles Machine Gun.

Improvement on Gatling gun, six or ten barrels, side feed.

Cânet's Electric Motor System for Turret Guns. French Naval Reserves for Coast Defense. Trials of the Batteries of the Revenge. The New French Battleships Charlemagne and St. Louis. The French 2d-Class Cruiser d'Assas. Accidents to French Torpedo-Boats. On the English Torpedo Cruisers. The Japanese Cruiser Yoshino. Comparison of the Navies of Several European Nations. The English Naval Buget for the Fiscal Year 1894 to 1895. The Batteries of Cruisers 2d-Class of the Talbot Type. Manufacture of Cordite in the English Government Works at Waltham Abbey. Experiments with Cordite. Minor Notices. H. G. D.

LE MONITEUR DE LA FLOTTE.

No. 8, FEBRUARY 24, 1894. Composition of the Italian Squadrons, 1894–1895. Coast Defense Regulations.

MARCH 3. The Defenses of the Island of Corsica. The Extra Parliamentary Naval Board of Inquiry.

MARCH 17. The Law of Promotion. The Navy in Parliament. The Extra Parliamentary Navy Board of Inquiry.

MARCH 31. On the Landing of Considerable Forces. Recruiting of the Borda (French Naval School).

APRIL 21. Battleships and Cruisers (4th Art.).

APRIL 28. The Italian Navy Appropriations. Testing of Armor Plates. J. L.

OBSERVATIONS AT THE MAGNETIC OBSERVATORY OF THE IMPERIAL NAVY AT WILHELMSHAVEN.

PART III., 1893. Hourly Observations for Variation for the Years 1886, '87 and '88.

PROCEEDINGS OF THE ROYAL ARTILLERY INSTITUTION.

VOLUME XXI., No. 3, March, 1894. Defense of Estuaries, Harbors, etc., Against Torpedo-Boat Attack.

The Committee published this paper in order to bring the question of how best to meet torpedo-boat attacks to general notice, and invite further discussion.

APRIL. The Necessity of a Firing Test to Prove Preliminary Training Complete. Supply of Ammunition in the Field. The Centenary of the École Polytechnique. Electro-Metallurgy of Aluminium.

REVISTA TECHNOLÓGICO INDUSTRIAL.

JANUARY, 1894. Artificial Open Lakes for Averting Inundations. Principles of Cotton Carding and Carding Machines. Resistance of Material. A Study of the Tests of Steel and Iron (cont.).

FEBUARY. Explosion of Steam Generators. Principles of Cotton Carding and Carding Machines (contin.).

MARCH. Explosion of the Steam Generatòrs (continued). Principles of Cotton Carding, etc. J. L.

REVUE DU CERCLE MILITAIRE.

No. 8, FEBRUARY 28, 1894. The Railway Extending from the Senegal to the Niger (with map). Electric Searchlights (with sketch).

MARCH 4. A Practical School of Artillery and Engineering in the Portugese Army. Electric Searchlights (ended).

MARCH 11. The New Regulations of the German Artillery Manœuvres. The European Sea Route to Liberia. Expedition of Lieutenant Dobrotvorsky.

MARCH 25. Organization of a Military Velocipede Service. Recruitment in the Italian Army.

APRIL 1. Apropos of the Duties of Advance Posts.

APRIL 8. A Winter Manœuvre in the Russian Army. The Officers of the French Army Reserve.

APRIL 15. Present State and Military Rôle of Aërial Navigation. The Islands of Formosa and Pescadores. Reorganization of the Swiss Army.

APRIL 22. Present State, and Military Rôle of Aërial Navigation.

APRIL 29. The German Service Powders. Present State and Military Rôle of Aërial Navigation. The Islands of Formosa and Pescadores. J. L.

REVUE MARITIME ET COLONIALE.

VOLUME CXX., FEBRUARY, 1894. Method of Fire for Low Coast Batteries. Aid to the Wounded and Wrecked in Naval Wars. A Supplement to the Study of Curves of Route-Powers.

MARCH. The Recent Naval Improvements. A Rapid Method for Determining the Straights and Curves of Altitude, and for

Working out a Reckoning. On the Use of a Searchlight Forward of High-Speed Vessels, in Order to Avoid Collisions at Sea. A Vocabulary of Powders and Explosives (continued).

APRIL. A Study of the War Navy. A Vocabulary of Powders and Explosives. J. L.

RIVISTA DI ARTIGLIERIA E GENIO.

FEBRUARY, 1894. On the Organization of Studies for Officers of the Engineer Corps. Double Acting Service Fuses, Models '86, '88, '91 and '92 in the German Artillery. Electric Accumulators. A History of the Field Artillery from 1815 to 1892. A New Model of Automatic Explosives.

MARCH. The Impending Field Gun. The Divisional Van-Guards; a Study.

REVISTA MARITTIMA.

MARCH, 1894. Phototopography:—New Notes on Phototopography, and Application of Photogrammetry to Hydrography. On Neutrality. Nautical Science from the IX. to the XVII. Century. A Cochrane of Steam Navigation (Lieutenant-Commander W. B. Cushing), by Alfred Mazza. (Supplement.)

APRIL. Mattis da Bergamo (His Unpublished Letter on the Early Relations with the East Indies in the XVI. Century). From the Old World to the New, and Vice-Versâ (Meteorological Notes). J. L.

SOCIÉTÉ DES INGÉNIEURS CIVILS.

JANUARY, 1894. Formula of the Process of Deformation in Rolling and Hammering.

FEBRUARY. Tunneling in Soft, Oozy or Loose Earth, (Sokolowski Method). Experiments and Study of Running on Curves of Rolling Stock. A Jet Condenser for Steam Engines.

J. L.

STEAMSHIP.

APRIL, 1894. The Making of a Modern Fleet. Amos and Smith's Steam-Steering Gears. U. S. Protected Cruiser Olympia. Water-Tight Bulkhead Doors (M'Elroy's). Recent Experiments in Armor.

MAY. Stone's Patent Side-Lights for Ships. Morgan's Patent Locking Fire Bars. New Rules for Approximate Integration. The Belleville Water-Tube Boiler. Ventilation of Ships.

H. S. K.

UNITED SERVICE GAZETTE.

No. 3190, FEBRUARY 24, 1894. The Stability of Ironclads, a Novel Suggestion. The Loss of the Victoria. Editorial: The Command of the Sea.

MARCH 3. The Operations on the Gambia. Stations of the British Army and Navy. Editorial: The Forthcoming Naval Estimates. Defense Organization. Physical Development of the Chest.

MARCH 10. The Operations on the Gambia. Editorial: Naval Efficiency.

MARCH 27. The New Naval Programme. The Making of a Modern Fleet. The Navy Estimates. Editorial: A Modern Fleet. The Fighting on the Gambia.

MARCH 24. Land Defense Against Torpedo-Boats. Appropriation Account of the Navy. Editorial: The Naval Estimates Debate.

MARCH 31. The Penetrative Power of the Lebel. Detachable Rams and Submarine Guns. Editorial: The Position of our Navy.

APRIL 7. The Penetrative Power of the Lebel. Stations of the British Army and Navy. Editorial: The Personnel of the Navy.

APRIL 14. Attack Versus Defence. The Destructive Effect of Projectiles (Small-Arms). Editorial: The Navy Estimates Debate.

APRIL 21. Prayer on Board Ship. Editorial: The Constitution of the Fleet.

APRIL 28. Communication between France and Russia in Case of a European War. Editorial: A Council of Naval Experts.

MAY 5. The Supply of Seamen. Lord Brassey on the Royal Naval Reserve. Editorial: The Unpreparedness of the Navy.

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